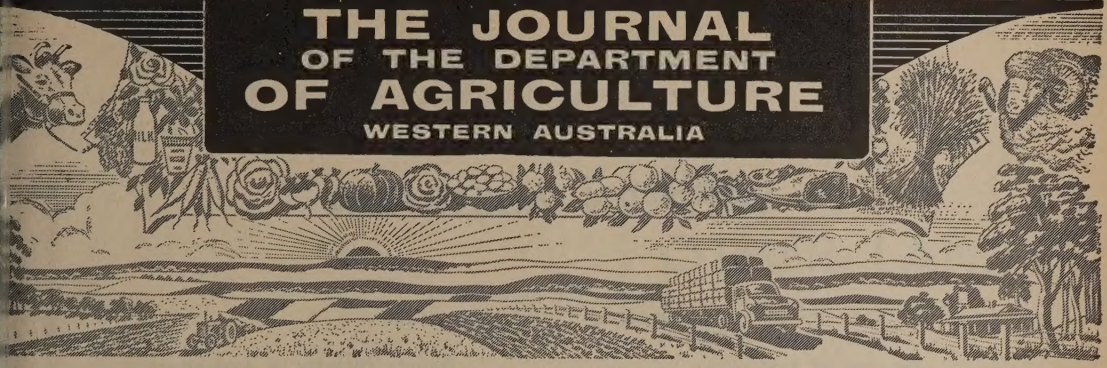
THE JOURNAL OF THE DEPARTMENT OF AGRICULTURE

WESTERN AUSTRALIA



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Edited by
J. A. MALLETT

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COVER PICTURE
Young Southdown stud rams on a property at Armadale

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The Fruit Industry IN OTHER LANDS

By F. MELVILLE, B.Sc. (Agric.),
Horticultural Adviser

3—THE UNITED STATES OF AMERICA

MY visit to the United States extended over a period of ten weeks and in this time fruit areas in New York State, Washington State and California were seen. In addition, certain other activities were covered in other centres. Contact with Research and Extension personnel was made at—

U.S.D.A. Marketing Service, New York.
U.S.D.A. Research Centre, Beltsville, Maryland.
Cornell University—Ithaca, New York, and Geneva, New York.
Tree Fruits Experimental Station, Wenatchee, Washington.
University of California, Davis, California.
Citrus Experimental Station, Riverside, California.
U.C.L.A. Agricultural Experimental Station, Los Angeles, California.
U.S.D.A. Marketing Service, Fresno, California.

New York State is one of the main apple areas of the north east and also produces large quantities of cherries and peaches, as well as being prominent in the growing of American-type grapes for juicing. Fruit storage is highly developed and it is here that "Controlled Atmosphere" storage was brought into commercial usage. Numerous cool stores were visited including the experimental chambers at Cornell University where work of world renown has been carried out by Professor Smock.

Washington State is the largest apple producing area of the world. Apple production and handling problems were discussed and crops were seen just prior to

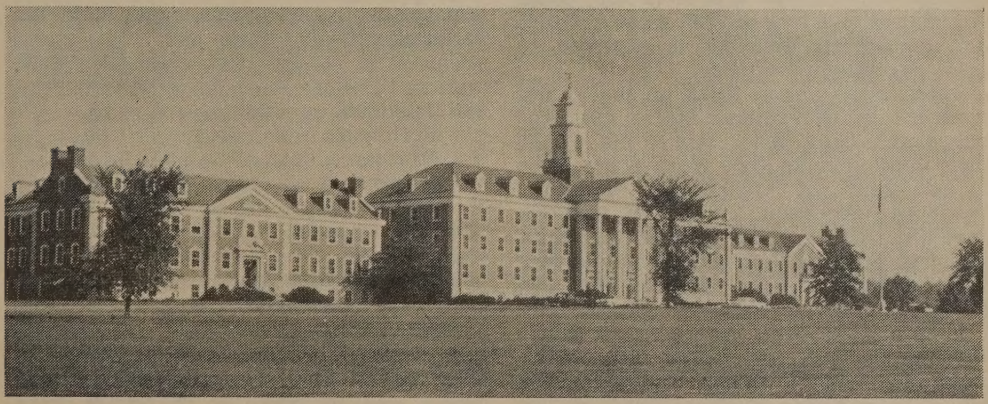

Fig. 1.—U.S.D.A. Research Centre Beltsville, Maryland, Horticultural Department

harvest. Pears and peaches are also produced in large quantities. Rainfall in the fruit areas is low and irrigation is universal.

California grows more temperate fruits. It is the centre of the grape growing industry and also a very important citrus area. Some time was spent looking at table grape handling and storage and also the citrus industry. Other crops of importance include peaches, plums, apricots, avocadoes, apples and pears, nut crops and olives. With the exception of some coastal areas, rainfall is low and irrigation is necessary for all fruit crops.

APPLES

THE downward trend in apple production apparent over many years has been arrested and, with the extensive new plantings which have taken place in recent years and the expected continuance of this trend, substantial increases in production are forecast. The present total of 120 million bushels is expected to reach 135 million bushels by 1965. Plantings over the past ten years have favoured the red strains, mainly of Delicious, while Golden Delicious is also very popular and heavy plantings are being made.

Delicious is by far the biggest variety with present production around 25 million bushels and expected to reach 34 million bushels by 1965. Washington State at present grows 15 million bushels of Delicious and could rise to 21 million bushels by 1965.

McIntosh, the second variety, is grown very extensively in the Eastern States of America and is not expected to change in production, but Winesap, Rome Beauty and Jonathan may increase by 10 per cent., 48 per cent. and 28 per cent. respectively by 1965.

The Golden Delicious indicates the most spectacular rise in production of over 100 per cent. between now and 1965 and whereas the ratio of Delicious to Golden Delicious at present is 6 to 1 this could be reduced to 4 to 1 in 1965 when production of Golden Delicious is expected to reach 8½ million bushels.

Approximately one third of the apples produced in the United States are processed for baby food, sauce, pie apple, slices and juice. In New York State, over 50 per cent. of apples are processed. Favoured processing varieties include Baldwin, Rhode Island Greening, and Northern Spy but Golden Delicious is very good for slices and McIntosh surplus also goes for processing. Delicious is essentially a dessert variety and some concern is felt over the heavy planting and future high production of this variety. Other major dessert varieties are Winesap, Rome Beauty, Cortland and Jonathan.

Extensive new apple plantings were evident in Washington State. A survey carried out in two of the main counties in 1957 showed that out of a total of 2,114,000 trees 45 per cent. were less than eight years of age and 62 per cent. of Red Delicious and 70 per cent. of Golden Delicious trees were non-bearing. This was partly the result of the replanting programme after the 1955 freeze and also the change to improved red strains of Delicious, Rome Beauty and Winesap. The total area of apples in Washington is approximately 60,000 acres and 2,700,000 trees are in production. Delicious accounts for over 50 per cent. of plantings.

VARIETIES

Fully 80 per cent. of the apple production in the United States comes from ten varieties viz.—

	Approx. Production. Million Bushels.
Delicious	25.
McIntosh	13.
Winesap	11.
Jonathan	7.5
Rome Beauty	7.5
York Imperial	5.5
Stayman	5.
Golden Delicious	4.5
Newtown Pippin	4.5
Baldwin	2.5

Increasing production is anticipated from Golden Delicious, Delicious, Rome Beauty and Jonathan, in the latter three varieties mainly from improved red strains.

Fig. 2.—The famed apple area of Wenatchee (Washington State)—The "Apple Capital of the World." The snow waters of the Columbia River make orcharding possible

APPLE AREAS VISITED

New York State receives summer rains and large-scale irrigation is not generally required. Orchards are grassed, trees are very large and labour costs are thereby increased. The main varieties grown are McIntosh, Red Delicious, Cortland, Rome Beauty, Rhode Island Greening, and Baldwin. The latter two varieties are used for processing. The McIntosh is the most sought-after dessert variety in America and with "Controlled Atmosphere" storage and consumer polythene packaging it has achieved a very prominent place. The big cities close at hand provide a ready outlet. Red Delicious is lacking in colour in some seasons and, because of this, interest is being shown in the new red sports developed in Washington State. New York experiences very cold weather and often damaging low temperatures are experienced at blossoming and setting time.

The apple areas of Washington State have developed on the alluvial plains formed by the large rivers of the Columbia system flowing through dry inland country with a rainfall below 10 inches. All orchards are therefore fully irrigated. The rivers are snow-fed and reach their peak flow in summer. Winters are cold and serious damage has occurred on occasions from freezing conditions. Otherwise climatic conditions are ideal for apples which grow extremely well. The Red Delicious predominates with Winesaps, Golden Delicious and Jonathans the other main varieties. The red varieties develop very good colour and the Golden Delicious grows to perfection. Total production is about 35 million bushels.

The land in its virgin state carries only a light sage-brush scrub so that land preparation costs are very low. The plant cover is easily handled by a brush shredder and, apart from some levelling, no further preparation is required before planting the trees.

The valley soils on which the fruit is grown have originated at least in part from the extensive basalt flows which overlie the main country rock and explain the fertility of these valleys. Natural terraces formed as beds of old perched lakes also

provide good orchard sites. They are level and above the damaging frost zone.

RED SPORTS OF DELICIOUS

New red sports of Delicious are being found continuously in Washington State.

Fig. 3. — A typical Red Delicious tree near Yakima capable of producing more than 50 bushels of fruit. The permanent grass cover is typical of Washington orchards

Last season at least ten were discovered making a present total of about 50 so-called "super sports" all with better colour than the older types, Starking and Richared. It seems probable that more new sports will be discovered in the future at something like the same rate but it is becoming less and less likely that types sufficiently different to permit patenting will be found. Many of the present sports are patented but unless some radically different characteristic can be demonstrated in a new sport, patent rights cannot be allowed. About 15 of the present super sports have been selected by nurserymen for propagation. They may be divided into two main groups for colour viz., "striped" and "blush" and two tree forms viz., "standard" and "spur" types. The blush is a solid colour as opposed to the stripe. Spur types have the characteristic of forming fruit spurs very readily and normally produce a smaller and more compact tree. They tend to bear younger, and fruit-set is heavier so that yields are about the same as from standard trees. The spur types show great promise but cannot be recommended without reservation until more information is available. One suggested practice is to make a double planting of spur and standard types on a 20 ft. spacing with a view to removing either one at some future date leaving a normal 40 ft. planting.

The main super sports are as follows:—

Name	Colour Pattern	Tree Form
Hi Early	Stripe	Standard
Hi Red	,,	,,
Red King	,,	,,
Top Red	,,	,,
Walt-Wood	,,	Spur } Still under
Cruichshank	,,	,, } obeerva-
Morgan	,,	,, } tion
Imperial	Solid blush	Standard
Houser Red	,,	,,
Royal Red	,,	,,
Ryan Red	,,	,,
Chelan Red	,,	Semi-spur
Hardi Spur	,,	Spur (under obser- vation)
Red Spur	,,	,,
Starkrimson (Bisbee)	,,	,,
Wells Spur	,,	,,

The majority are sports of Starking. Those most favoured at present are Hi Early, Walt Wood, Ryan Red, Starkrimson and Wells spur. The spur types seem likely to become very popular and nurserymen are propagating them heavily. Red Delicious apples in Washington have a characteristic long tapered form with a pronounced crown at the calyx end and new sports are being selected to retain this Washington "trade mark." The main emphasis has, however, been on colour and some of the newer selections are not

only completely dark red but develop full colour six to eight weeks before maturity.

ROOTSTOCKS

Most apple trees are still being propagated on seedling stocks. Delicious seedlings are considered to produce the most uniform stocks in New York State and by culling out over-vigorous and weak plants a very even stand can be obtained.

Because of the increasing labour costs associated with large trees, much more interest is now being taken in the possibility of using semi-dwarf stocks allowing more trees per acre but giving somewhat the same per acre production. No widespread move has yet taken place in this direction because of the limited information available.

During the war a full selection of stocks was sent over from East Malling for safe keeping and these are providing material for rootstock work.

A trial with various English stocks is being conducted at Geneva and is now in its fifth year. So far the only points of note to emerge are that MM 104 has not yet proved very fruitful and MM 111 seems somewhat dwarfing. *Malus sikkimensis* is giving earliest cropping but the fruit tends to be small. Northern Spy, which on seedling stocks does not fruit until 10-12 years, has cropped on *M. sikkimensis* at four years.

Fig. 4.—Starkrimson Red Delicious super sport fully red a month before harvest

Commercially, trees which are dwarfed by means of a Clark interstock have met with varying success. The Clark stempiece is thought to be identical with Malling VIII and where used alone has produced trees with varying degrees of dwarfing, depending upon the length of the stem-

Fig. 5.—Starking Red Delicious—the elongated shape with prominent calyx crown is typical of Washington. Delicious

piece and the growing conditions. The trees have cropped well particularly with Golden Delicious as the scion. Virginia Crab has been used as a stem-builder for winter hardiness with a Clark stempiece above and in some cases the stem-pitting virus has been introduced. This causes the Virgina Crab to lose its stability and the tree to bend over.

One commercial planting was seen in Washington trying out Red and Golden Delicious on M IX trained on a trellis. At two years, the trees were yielding up to one bushel per tree equivalent to over 500 bushels per acre. However, the increased work of training might tend to offset advantages in other respects.

Bush trees on Malling II, IV and VII were also being tried. The main problem here was the need for staking to hold the trees upright particularly those on M VII.

At Geneva the problem of eliminating staking was being tackled by working high on M IX and then planting deep. At four years the trees were quite firm in the ground and were cropping. M I material was found to contain the rubberywood virus.

POLLINATION

Golden Delicious is commonly planted as a pollinator for Delicious. Golden Delicious sets quite well on its own but is usually planted adjacent to other varieties. Blossoming period is usually very short and strong bee activity is needed for a good setting. Some hand-pollinating is done, but pollen inserts in hives have not proved satisfactory. The hire of bees for pollinating purposes cost about 8½ dollars per hive.

SOIL MANAGEMENT

The general trend in the areas visited is towards non-cultivation with some type of permanent cover. In New York practically all orchards seen were laid down to sod which normally took the form of natural grasses mowed at intervals to prevent tall growth. In no case, however, was the English practice of closely mowing swards seen.

In Washington State, permanent covers consist mainly of volunteer grasses which are mown at infrequent intervals, in some instances only three to four times per year. It is quite common to see high grass in the orchards in the summer. All orchards are irrigated and fertilised with nitrogen and there was no apparent competition from the grass cover. Young orchards are grassed down soon after planting, and weed competition with young trees is dealt with by mulching with straw or more recently by herbicide sprays which are also being used under older trees particularly for the control of certain perennial weeds. Weeds such as convolvulus and creeping ivy are still proving a problem and no completely satisfactory herbicide has been found. Lucerne is often used in Washington orchards in the early years but in older orchards it tends to go out on account of shading.

FERTILISERS

Nitrogen is the main major element applied to apple orchards. No response to phosphate or potash has been demonstrated and these fertilisers are not normally used. Some orchards seen were applying little or no nitrogen in order to get better fruit colour but this practice was considered to be detrimental to the trees in the long run. Trials with summer urea sprays in progress at Wenatchee have so far shown no improvement in fruit size.

IRRIGATION

Irrigation is not generally practised in New York State, even where water is readily available, as this area normally receives summer rains. In Washington State, however, where the apple areas receive less than ten inches of rain per annum irrigation is essential. Annual applications are in the vicinity of 35 inches in about ten applications. On light soils, as much as 50 inches may be used. The water is readily available from the Columbia River system traversing the dry inland country and is usually brought to the orchards in large contour channels. The water is usually applied by sprinklers. Some orchards located on the river banks are watered from private pumps. There is a tendency to over-water in some cases due to the ample supplies available. Work is in progress at Wenatchee to formulate a plan based on evaporimeter measurements by which growers can be advised regularly throughout the year of the optimum intervals between irrigations.

HERBICIDES

The problem of how to chemically control weed growth under apple trees growing in permanent sod, without damaging the trees, is engaging the attention of research workers in numerous centres. Many materials are being tried including Dalapon, Diuron, Amino triazole and Simazine used both singly and in combination, but recommendations have not yet been made. The control of weeds around young trees is of primary importance and these are the most susceptible to injury. Injury takes the form of foliage bleaching, leaf curling and marginal scorching and in extreme cases death of the young tree.

Fig. 6.—Hardy Spur—a spur type Red Delicious sport

Dalapon—Up to 10 lb. per acre gives slow but fairly good control of grass but may need to be repeated and also may permit non-susceptible weeds to flourish. It is reported that two sprays of 5 lb. per acre one to two weeks apart are more effective than one spray of 10 lb.

Amino triazole—Effective mainly against broad leaved plants but gives partial control of grasses. Applied at 8-10 lb. per acre it is effective for several months but must be repeated. Young trees can be injured and at present 8 lb. applied with not more than 100 gallons of water per acre is suggested as the upper limit for apple trees.

Diuron—At 8 lb. per acre has given very good weed control but this rate is too high for safety. At 2 lb. per acre no injury has occurred but the effect on weed growth was slow and the overall effectiveness except on germinating annual weeds rather poor.

Simazin—Limited trials suggest this soil sterilant material to be safer than Diuron and possibly more effective. Six lb. per acre is normal but higher rates have not caused injury. It is slow in action.

None of the materials is completely effective used alone due to the low rates which must be used to avoid tree injury. Better results have been obtained with combinations such as Dalapon—Diuron 10/8, Dalapon—Amino triazole 10/2 and Amino triazole—Simazin 8/8. Work is continuing on these lines and also with triple mixtures. Even so, more than one spray per year may be required for complete weed suppression. Damage to young apple trees was seen resulting from a spring application of 5 lb. Diuron plus 10 lb. Amino triazole per acre although weed control was very good.

Other materials being tried are Eptam a product of the Stauffer Chemical Co.

Fig. 7. — Golden Delicious trees with Clark dwarf stem pieces to limit the size of the trees

(a mild sterilant and possibly useful for nut grass control) and Atrazine also suggested for nut grass control a 2½ to 4 lb. per acre. Neither is suggested for use around trees.

PLANTING DISTANCE TRIAL

The effect of filler trees in an orthodox planting is under trial at Wenatchee. Permanent trees are 40 ft. apart and these are interplanted to give a 20 ft. square planting. Varieties are Delicious, Golden Delicious and Winesaps. Treatments consist of removing the fillers at two year intervals commencing at nine years to observe the effect on permanent trees. Results to date at 12 years have shown that retaining the fillers has had no serious affect on the yield of permanent trees although much higher per acre yields are possible in the early years by closer planting.

STOP DROP SPRAYS

N.A.A. and 2.4.5.T.P. are used, the latter being preferred in Washington because of its greater effectiveness and the longer period of action. It permits Delicious and Winesaps to be sprayed at the one time. In eastern fruit areas accelerated maturity has been reported following the use of 2.4.5.T.P. sprays but this effect has not been found in Washington. Stop drop sprays are often applied from the air in concentrated form.

RUSSET ON GOLDEN DELICIOUS

Russet is not normally a problem with Golden Delicious in Washington but factors found to induce russetting are cold nights at setting time in conjunction with sprays particularly parathion and also moist conditions.

CHEMICAL THINNING

Chemical thinning of apples is now on accepted practice in the areas visited, partly as an answer to the heavy hand-thinning costs on the large type of trees grown, but mainly to regulate the biennial bearing habit of such varieties as Golden Delicious, Red Delicious and Winesaps. In New York State N.A.A. at 15 p.p.m. or the amide at 50-70 p.p.m. are normally used at 12 to 18 days after full bloom except amide on Delicious usually at petal fall. In this part of America the blossoming period is very short amounting to only two to three days in some years, and timing sprays is difficult when weather conditions are unfavourable. Where single sprays are to be used, N.A.A. is often preferred, but recently multiple sprays of low concentration with Tween 20 added have been tried experimentally and are now being used by some growers.

Fig. 8. — Golden Delicious trained on a wire trellis in a growers trial using Malling IX dwarfing rootstocks. Production estimated at 500 bushels per acre in the second year

The procedure is to apply an amide spray at petal fall and if necessary follow this with N.A.A. about 14 days later. If thinning is still not quite adequate a second N.A.A. spray is used. Spray concentrations are 5 p.p.m. N.A.A. and lower. There is apparently no cumulative effect of the chemical. Tween 20 is used to increase absorption and permit the use of low concentrations. Sprays are applied with speed sprayers which do not always give the desired distribution but are quick and reduce labour costs. Variable absorption appears to be a basic problem with thinning agents. Absorption is increased by high temperatures, damp weather or heavy frosts and over-thinning can easily occur. Chemical thinning is still a very technical operation requiring careful understanding and judgment on the part of the grower to attain success. Chemically-thinned Delicius, Golden Delicious and McIntosh were seen, the fruit being well-spaced and of good even size.

In Washington State, over 25,000 acres of apples are spray-thinned annually. It has proved effective in overcoming the biennial bearing habit of the main varieties Delicious, Golden Delicious and Winesap, but does not do away with the need for detailed hand-thinning.

From experience over a number of years, the Research Service has evolved a procedure for commercial thinning, the main object of which is to minimise the risk of over-thinning. This has been achieved by spreading thinning over as wide a period as possible with the idea of lessening the overall effects of unfavourable weather conditions and other factors influencing fruit set.

At full bloom, a relatively weak dinitro spray is applied which in some years only brings about limited thinning but in no year should produce disastrous results. On the average about half the desired thinning is accomplished. Spraying of a particular orchard is also spread over several days to further reduce the weather hazard. Dull wet weather after spraying will greatly increase the thinning effect of dinitro sprays and in the case of Red Delicious it is sometimes thought too risky to use this material. In any case a lower concentration is recommended. Dinitro sprays are very satisfactory for Golden Delicious and Winesaps.

At 14 to 18 days after full bloom it is possible to determine the effectiveness of the first spray and if necessary apply a second spray of either amide or naphthalene acetic acid. This is also a weak spray with Tween 20 added to increase absorption. Tween 20 tends to stabilise the amount of thinning since under poor absorption conditions it increases uptake whereas when absorption is good it has little additive effect. A "Colloidal spray modifier" has recently been tried as a substitute for Tween 20 with good results. The amide is recommended for Golden Delicious and Winesaps but is not normally

used on Delicious because of the numbers of small pigmy-type fruits which are retained by its use.

The recommended programme in Washington State is as follows:—

Stage	Variety	Material and Amount per 100 Gallons*	Wetting Agent and Amount per 100 Gallons
Full Bloom Period	Delicious and Winesap	2/3 pt. Elgetol or	None
		1/3 lb. DNOC 40% Powder	None
	Golden Delicious .	2/3 to 1 1/3 pt. Elgetol or	None
	Jonathan, Yellow	1/3 to 2/3 lb. DNOC 40% Powder	None
14 to 18 Days past Full Bloom	Golden Delicious and Winesap	2/3 pt. Ana-Amide or 1/6 lb. Amid-Thin	2/3 pt. Tween 20 or 2/3 pt. Triton X–100
14 to 18 Days past Full Bloom	Delicious and Winesap	2 1/2 ppm NAA †	2/3 pt. Tween 20
	Golden Delicious Yellow Newton and Jonathan	3–1/3 ppm NAA ‡	2/3 pt. Tween 20

* Concentrations given may be altered up or down 50% depending on weather, tree age, vigor, pollenizers and spray method.
† Naphthalene acetic acid (¼ drop concentration).
‡ Naphthalene acetic acid (1/3 stop drop concentration).

Various factors influence the effect of chemical thinning agents. The following have been summarised by Dr. Batjer.

Factor	Tendency to Thin More	Less
Rain following spray	Rain	No rain
Humidity before spray	High	Low
Drying rate of spray	Slow	Fast
Minimum temperature after	Low	High
Maximum temperature after	High	Low
Spray concentrations	Strong	Weak
Tree vigor	Low	High
Tree spacing	Close	Adequate
Pruning	Light	Heavy
Air drainage	Poor	Good
Bloom	Heavy	Moderate
Pollination	Poor	Good
Variety (pollen status)	Unfruitful	Fruitful

Just recently an insecticide "Sevin" (1-napthyl N-Methylcarbamate) has shown considerable promise as a thinning agent and is being further investigated. In the initial work 1½ lb. of 40 per cent. powder per 100 gallons was used three weeks after full bloom.

HAND-THINNING—HARVEST SIZE PRODUCTION

In New York State, detailed hand-thinning following chemical thinning is not widely practised. In Washington State, however, it is normal practice possibly due to the better setting conditions which normally prevail.

The degree of thinning by chemical sprays varies considerably from tree to tree and in order not to over-thin some the majority of trees will be under-thinned. If it is accepted that 30 fruits per 100 blossom clusters (30 per cent.) is the desired final set, then some trees will have at least 50 per cent. set to avoid over-thinning on others. Some hand-thinning is therefore necessary, but as the main burden on the trees has been removed by chemical thinning there is less urgency to complete the hand work. The more progressive orchardist is now using fruit measurements and harvest size prediction tables to determine hand-thinning requirements.

At 50 to 60 days after full bloom the orchard is gone over quickly, thinning out heavy clusters, but detailed hand work is left till later. At about 70 days from full bloom, it is possible to determine fairly accurately from fruit diameter measurements and reference to tables prepared by the Research Service what the final harvest size will be. Twenty fruits from each of ten trees is considered an adequate sample to determine average fruit diameter. Measurements are made with steel tape calipers. The size prediction tables have been compiled from extensive fruit measurements taken over a number of years and show for any variety and size at any period from full bloom what the harvest size will be. If measurements indicate harvest size will be below requirements, then fruits below the minimum

Fig. 9.—Lucerne (alfalfa) is commonly used as a permanent cover crop in Washington orchards

diameter required are removed, having due regard for the effect of thinning on the remaining crop. Hand-thinning should be completed not later than 90 days from full bloom. The uniform growing conditions which prevail with adequate irrigation make fairly accurate prediction possible. Nevertheless, considerable skill is required to assess the position correctly.

One cannot but be impressed by the uniformly good size and quality of Washington apples.

Red Delicious sports are now being grown in increasing quantities and as these colour weeks before normal harvest maturity, growers are tempted to pick too early. However, as the fruit requires an official permit issued by a departmental

Fig. 10.—Irrigation is essential in Washington State. Applications range from 35 in. to 60 in. per annum

inspector for transport, growers are careful about harvest maturity.

To assist growers, a Delicious maturity Committee comprising growers, packers and Government Officers makes a tour of the main Washington areas just prior to harvest and examines representative orchards. At each property, maturity is assessed on the basis of ground colour, flesh colour and taste and from the resultant information release dates are agreed upon. There is normally an initial opening date for early situations and a general opening date for the whole State. Opening dates are also fixed for McIntosh in New York. It is essential that apples going into "Controlled Atmosphere" storage are of the correct maturity as costly deterioration can result from storing immature or over mature fruits.

BULK BINS

Bulk-handling has not as yet been developed commercially in New York State although the matter is under consideration on a trial basis. One of the problems is the loose storage of McIntosh for long periods in "Controlled Atmosphere" storage. It has been found that the bottom apples will develop pressure bruises in the normal type of bulk bin under these conditions.

In Washington State, the use of bulk bins is developing rapidly. In 1958 something like 15 per cent of the crop was handled in bulk and in the 1959 season a considerable increase was expected. Packing houses are encouraging bulk-handling and many would switch over completely if growers were in a position to deliver in bulk. The changeover depends upon growers installing suitable equipment and the cost of the bins.

All bins in use are the portable type holding approximately 25 loose boxes of fruit. Common measurements are 47 in. x 47 in. x 29 in. outside measurements with a pallet base leaving an inside depth of about 24 in., but the size is by no means standardised. Various types of construction are used including heavy plywood with corner supports, butted horizontal boards, spaced horizontal boards and vertical boards with cross-bracing. In some

Fig. 11.—The opening picking date for Red Delicious is determined by a Committee representing the growers, packing houses, and local Departments following visits to representative orchards throughout the State of Washington

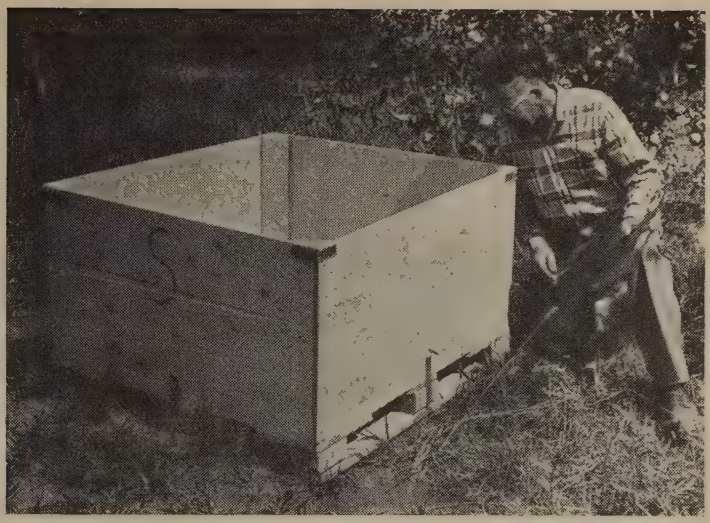

Fig. 12.—Plywood bulk bin—Canadian pattern

instances the bins are of open construction completely lined with corrugated board. Both two way and four way pallets are used. Bins are of pine and normally dipped in pentachlorphenol wood preserving mixture before use. Cost varies from 8 to 12 dollars (72s. to 108s.) each but this is considerably below the cost of the equivalent capacity in standard picking boxes.

Contract picking rates are usually about 12 cents per box or 3 dollars (27s.) per bin but may go as high as 20 cents per box, for special picking of tender varieties such as McIntosh and Golden Delicious. Picking into bulk bins is quicker, saves the grower money and is preferred by pickers. The overall saving from the use of bulk bins is estimated at equivalent to 5 cents per box. The change over to cardboard cartons has accelerated the move to bulk bins as the practice of taking new wooden boxes into the orchard as picking boxes is no longer possible.

Bins are handled in the orchard on tractor mounted fork-lifts (both front and rear mounted) which stack the bins one or two high in a row on planks to be picked up by straddle trucks or less expensive straddle trailers for transport to the packing shed or cool store. Haulage up to ten miles is considered economical. Large semi-trailer-type straddle trucks which haul 18 bins of 1,000 lb. each per load cost over 10,000 dollars.

All dumping in the packing shed is done mechanically. For field boxes a destacker handles stacks of six boxes, automatically tipping one box at a time on the conveyor. All sheds plan to dump bulk bins and several types of equipment are available for doing this. It is claimed that dumping fits into shed procedure better than run-

Fig. 13.—Straddle trucks transport bulk bins from orchards to packing house. Wenatchee

ning the fruit out through a trap door and causes less damage. Some fruit is being stored in bulk bins stacked up to eight high.

MARKET CONTAINERS

As the result of market demand, practically all apples are now packed in cardboard cartons. The change from wooden boxes occurred very quickly and was due to the demand from supermarkets, who are now the main, and in some areas, the only distributors of fruit and can dictate the type of fruit they require and its manner of presentation.

In the east, cell packs are popular because of the greater protection required for varieties such as McIntosh and Golden Delicious. Consumer packs of 3 to 6 lb. per film bag packed in cartons are also common in the east and are being increasingly used in the west. However, the main pack used in Washington State is the carton moulded tray pack, again at the demand of the supermarkets, who use the trays for display purposes. The tray pack carton is about the same price as the wooden box and packs all counts in the one-sized carton although 24 different trays are used. The cell pack carton is approximately 40 per cent. dearer and seven different sized cartons are required to cover the normal range of counts. Less than 1 per cent. of cartons used in Washington are cell pack.

Difficulties in stacking cartons for storage have not been completely overcome. One method has been to use stabilisers consisting of 2 in. x 1 in. vertical timber supports placed within each three-tier pallet load to take the weight of the pallet above as the cartons settle. These have proved fairly successful.

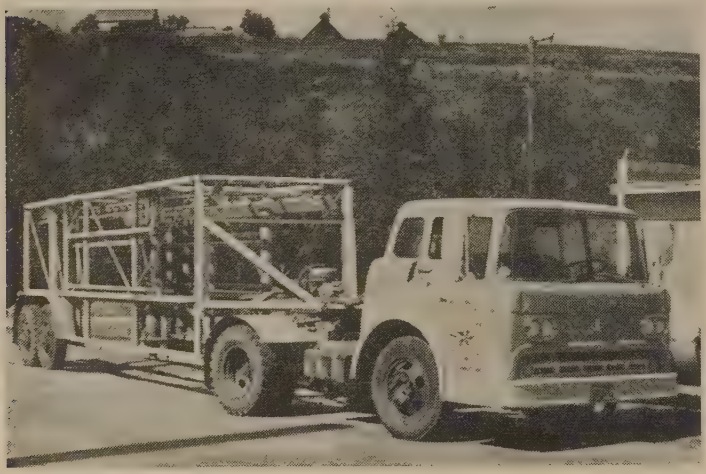

Fig. 14.—A straddle semi-trailer used for hauling 18 bulk bins at a time from the orchard to packing house. Wenatchee

Carton manufacturers and distributors are experimenting with bulk cartons to carry up to 500 lb. of fruit.

GRADING AND SIZING

Procedure differed in the areas visited. In the east, the fruit was seldom washed and particularly in the case of McIntosh the fruit was often hand-sized to minimise bruising. An orchard was visited where over 100,000 bushels are handled during the year without mechanical sizing or handling equipment. Much of the fruit was being put in consumer film packs with a range of sizes usually from 2¼ in. to 2¾ in. in the one bag. These were normally marked as "2¼ and up."

One packer was taking advantage of the publicity value of controlled atmosphere storage by describing the fruit as "air conditioned" on the polythene container.

In Washington all fruit is washed and dried at the beginning of the packing line. Sorting is done on conveyor belts usually passing through draught-proof heated rooms. Extra Fancy and Fancy grades are

Fig. 15.—Blue Star Growers Packing House Cashmere (Washington) with cold storage capacity of 500,000 bushels

normally used and C grade is only packed in bad years. There is a move to prohibit the marketing of C grade it being contended that such fruit would be better sent for processing. Combination grades are rarely used.

Apples and pears may be shipped in any of the specified containers either packed or jumble-filled provided they comply with grade and are properly marked. Packed boxes conform to standard counts and there is a minimum size requirement of 2½ inches. Fruit may also be shipped loose in unlidded containers including bulk containers, provided grade requirements are met. Provision is also made for the

Fig. 16.—Modern Packing House set-up—Yakima. The washed fruit is dried, graded and sized before coming onto the return flow belt for packing into tray pack cartons

marketing of sound culls but the packaging requirements are sufficiently exacting to effectively prevent the economic marketing of this low-grade fruit. There is at present a move to restrict the marketing of apples to extra Fancy and Fancy grades thus eliminating C grade. The legal position is being investigated.

Cutler type weight sizers are still widely used with rotary bins. The latest equipment consists of a diverging roller type sizer feeding on to a return flow belt from which the apples are packed. This equipment lends itself to mechanical packing.

PACKING

Hand-packing as we know it is no longer practised for apples. Less skilled labour is needed to prepare tray packs and in many sheds mechanical tray packing equipment is used. Some fruit for long storage is wrapped in purple wraps mainly to isolate any rots which may develop.

Volume fill is used to a limited extent. The fruit must be graded and above a minimum size usually 2¼ in. The guaranteed net weight is marked on the box together with other details.

Telescopic cartons come to the packing line flat and are made up by the packer as each one is required. After filling they go on to a conveyor line where bottom and top flaps are automatically glued. Details of the count are stamped on by the packer.

STORAGE

The production of apples for fresh fruit consumption approaches 80 million bushels and the majority of these are required for local consumption. Large quantities must be stored to keep the market supplied throughout the year. Cool stores are usually associated with commercial packing houses but many growers also have their own stores. In the east, apples are normally stored loose ungraded and unsized and packed out of cool store. In Washington on the other hand the fruit is often packed before storage, although with increasing use of bulk bins the practice of storing loose may increase. The high chambers now being built (21 ft. or more) lend themselves to mechanical palletised handling of bulk bins or market boxes. Where standard type boxes are used they are stacked six pallets high, three boxes high on the pallets. Wide doors and automatic door openers enable fork lifts to pass freely in and out of the chambers.

Storage temperatures are kept in the vicinity of 31° F. Trials have shown storage life to be 25 per cent. greater at 30° than at 32° F. However, the McIntosh variety is subject to injury at these temperatures and cannot be stored with safety below 38° F. At this temperature, storage life is much reduced and in an endeavour to improve the position Controlled Atmosphere storage, developed originally in England, was introduced and adapted to American conditions by Prof. R. M. Smock of Cornell University. This method of storage has increased rapidly in commercial usage in recent years. C. A. storage entails storing in low oxygen (3 per cent.) and high carbon dioxide (2-3 per cent. for most varieties) by which means storage life can be doubled. McIntosh in good condition were still being removed from store in July more than ten months after harvest. One of the main differences between fruit stored in normal air storage and C.A. storage is the greatly improved shelf life of the latter (up to three weeks compared with one or two days). The commercial development of C.A. storage has been most rapid in New York and neighbouring States where McIntosh predominates and where the main experimental work was carried out. In the Hudson Valley area over 25 per cent. of the storage space is C.A., in New York State in 1958-59 18 per cent, or more than 1½ million bushels were stored this way and in U.S.A. as a whole 3 million bushels or 5.3 per cent. of the total crop. Some interest is now being shown in Washington State as a means of extending Delicious storage but early trials have shown some loss of flavour. Varieties other than McIntosh being C.A. stored are Jonathan, Delicious, Golden Delicious, Rome Beauty, Northern Spy and Stayman. The largest Controlled Atmosphere storage seen was a commercial plant with a capacity of 100,000 bushels. Growers are also building small C.A. stores.

Controlled Atmosphere stores are built in similar fashion to orthodox stores except for special arrangements for making the chambers airtight by lining them with gas-proof materials. Lining materials

Fig. 17.—A heavy swing to cartons for apples has occurred in Washington State in the last two years. Cartons are also being tried for other fruits

consist of galvanised iron, aluminium, bitumised glass fibre, specially coated plywood, etc., carefully over-lapped and sealed. A special air-tight door with escape door and sampling porthole is sealed on to the inside of the doorway. Each chamber is checked carefully for leaks under pressure with a mano meter before use. Freedom from leakage is extremely important as changes in chamber temperature can bring about considerable air exchange.

The chambers are filled ideally in not more than ten days. Excess carbon dioxide is removed by scrubbers and once the atmosphere has stabilised at the desired concentration it is maintained by testing twice per day and adjusting as required. Water-scrubbers now look like replacing caustic scrubbers although in the early stages of storage some caustic may still be an advantage. The oxygen level must not go below 2.5 per cent. or suffocation can result. High humidity (90-95 per cent.) is necessary. In the Western States of America there has been less interest in Controlled Atmosphere storage because the varieties grown normally store well, although in Washington C.A. storage space is now approaching 200,000 bushels. This will be used mainly for Delicious and Golden Delicious.

This method of storage has had a decided impact on the marketing of apples. With McIntosh now available for a large part of the year the competition is being felt by other varieties such as Winesap which previously had limited competition on the late market.

Cold storage charges are generally low —about 35 cents. for six months normal cold storage, 65-75 cents for nine months C.A. storage.

SCALD STUDIES

Diphenylamine has proved very effective as a control for scald on all susceptible varieties. As most of the apples are stored unwrapped, the interest is in tree application or post-harvest treatment. Toxicological studies commenced with technical grade DPA showed this material to be unsatisfactory for feeding trials so that tests have had to be repeated with a more highly purified material. This means that any clearance given will be for the higher grade DPA but this is not expected to materially increase the cost per case. A further complication is the requirements by health authorities that DPA must not

Fig. 18.—Refrigerated road transports carry fruit interstate under ideal conditions. Capacity approximately 800 bushels

appear in the milk of cows fed with peelings from processing factories. A decision on the permissibility of DPA is not expected before the middle of 1960.

Santoquim, a chemically similar compound, when applied as a pre-harvest tree spray, has proved inferior to DPA but with delay in harvesting Santoquim has shown less loss in effectiveness than DPA. Steam application of DPA to harvested apples is being investigated following on work initiated in Tasmania. Academic studies of the effect of DPA on amino acids during ripening of the fruit are also being commenced.

PRECOOLING

Considerable work has been done in Washington to investigate the rates of cooling of cartons and also bulk bins. The cooling of cartons is slower than for wooden boxes but when separated to provide air movement around the container cooling can be as much as twice as rapid as when close stacked on pallets.

With bulk bins, 10 per cent. of the bottom and sides should be occupied by space to allow air movement. This will have twice the cooling capacity of a bin made of butted timber.

MARKET GRADES AND INSPECTION

Fruit is marketed under two sets of regulations viz., Federal regulations administered by the U.S. Marketing Service and State regulations which are a function of the State Inspection Service. State regulations closely follow Federal regulations but are sometimes more exacting particularly as regards colour.

In Washington State, inspections are carried out by the State Inspection Service as a requirement for shipping fruit out of the State. Inspectors are located in all centres and in all major packing houses and issue on request either State Transport permits which certify grade or U.S. Inspection Certificate which also cover condition. The latter are often requested by merchants in distant centres as a term of contract, particularly where delivery is to be taken at a later date after a period of storage. Transport drivers may be stopped on the road to check permits. The Inspection Service is self-supporting on fees which are charged for all inspections. The rate is $1\frac{3}{4}$ cents per box for an initial inspection and two-thirds this rate for subsequent check inspections.

The Federal Inspection Service carries out mainly check inspections on request at the destination outside the State of origin. They will also adjudicate on questions of compliance with grade and fruit condition.

PEST AND DISEASE CONTROL

Apple scab is not established in Washington State. No special precautions are taken to prevent introduction of the disease and it must be assumed that the conditions are unsuitable for its develop-

ment. In New York State, however, a full scale spray programme of 10 to 12 sprays is necessary for its control. A new fungicide under trial—cyprex—is proving very effective against scab and may prove superior to captan. It could be useful against pear scab but at present is more expensive than captan and is phytotoxic at concentrations slightly higher than that necessary for scab control. Organic mercuries are not used.

Powdery mildew is now a more troublesome disease to deal with than scab owing to less positive means of control and the build-up which has occurred following the change from lime-sulphur to captan for scab control. It appears unlikely that growers will return to lime-sulphur because of foliage and fruit damage. Best control is now being obtained with a series of spray (usually 5) of Karathane ($\frac{1}{2}$ lb./100 galls.) commencing prior to blossoming. Cyprex is showing some promise as a dual purpose spray for scab and powdery mildew but as yet is very expensive at the rate required.

Spider mites are undoutedly the most difficult pests to control due to the rapidity with which they build up resistance to the new insecticides. As in other apple growing countries mites often build up to major proportions during the summer, despite repeated sprayings. Kelthane is one of the few materials still giving a reasonable measure of control. Some growers have also managed to keep the mites in check by using a range of carefully selected insecticides.

San José scale is only a serious problem with apples and pears in some areas and occurs mainly in limited parts of the west coast, particularly in Oregon. The numerous native hosts of the pest make control difficult. Late dormant oil plus lime-sulphur is found very effective, and in limited trials oil plus parathion has shown some promise. Parathion sprays are applied later if required.

Codling moth is a serious problem in some areas in some years owing to the development of three broods. Resistance to DDT and allied materials has been noted at Geneva, New York.

APPLE BREEDING

The main apple breeding work was seen at the Agricultural Experiment Station, Geneva, where a breeding programme has been under way for many years, and entails making a number of controlled crosses each year.

Fig. 19.—Washington State Department of Agriculture, Inspection Service, Yakima

After emasculation of the flowers, pollen is applied with the finger—blossoms are not covered as with petals removed there is no attraction for bees. Delicious has been found completely unsuitable as a maternal parent but is used as a pollinator. It is usual to pollinate two flowers in a cluster and if both set to remove one. Some 100,000 seedlings resulting from these known crosses are under test in varying stages and 700 selections are set out for further assessment. In the initial seedlings blocks trees are planted 1 to 3 ft. apart in rows wide enough to enable the passage of machinery. The breeding programme is aimed at developing both processing and dessert types of dual purpose varieties.

Although many interesting apples have been produced, none to date appears likely to displace present commercial varieties. Two introduced Canadian selections viz., Ottawa 272 and 292 could prove of value as early varieties. They are red dessert types ripening in early August. When seen the fruit was fully ripe and rather soft.

CHEMOTHERAPY FOR VIRUS CONTROL

Investigations at Wenatchee aim at developing a means of controlling virus damage to plants by chemotherapy. It is hoped to inactivate the virus chemically by changing its chemical makeup in such a way that a stable nonsynthetic form is developed which will actively resist the development or multiplication of the injurious form. At present virus inactivation has only been possible within about 24 hours of infection. *Physalis flaidana* is being used as the indicator plant in this work with apple mosaic as the virus under test.

Methods of inoculation consist of macerating an infected leaf, mixing with carborundum and spraying on to the test plant.

Indexing plants being used for general work were:—

Cucumber—Chicago Pickling for stone fruit ring spot and sour cherry yellows.

Physalis flaidana—for apple mosaic.

EMU FENCES DAMAGED

The Minister for Agriculture (Mr. C. D. Nalder), said recently that although sections of the Vermin Fences System provided an excellent protection to the main farming areas against emu invasions, hunters travelling along the fences illegally had caused serious damage to the fences.

It was recently stated by a leading farmer from the Ajana district that the new spur fence in this area had given complete protection to the farmers on the west side during last season's emu migration. Over 8,000 emus had been destroyed in the district mostly when moving along the outside of the protection fences. If these fences had not been there the farms would have lost most, if not all, their crops.

Despite the well-proved value of these fences, the No. 3 Fence to the East of Ajana had been badly damaged on several occasions. In one case, someone had deliberately cut the wires in order to drive through and left an opening just where emus would be concentrated by a sharp angle. A motor traffic pass and gate were close by. In other cases trucks appeared to have been deliberately driven through the fences and damage resulting from vehicles which appeared to have accidentally hit the fences is fairly frequent.

The Lake Moore Emu Fence which was recently completed at a cost of over £60,000 has also suffered badly. Before this fence was even finished someone cut through a completed section and since then vehicles have been driven through at several places.

Mr. Nalder said that although travelling along the fence tracks without a special permit is illegal, it is difficult to catch offenders. However, apart from the cost and trouble caused, deliberately or accidentally leaving the way open for emus to pass through the fences is a serious matter. Substantial fines have been provided in the Vermin Act for illegal travel along, or damage to, the fences and it may be necessary to use special patrols to detect offenders.

The champion Southdown ram at the 1959 Perth Royal Show, exhibited by R. A. Hughes of the Cluden Newy Stud, Longford, Tasmania

The champion Southdown ewe at the 1959 Perth Royal Show, exhibited by M. K. Reynolds, Meckering

Famous Sheep Breeds

6.—THE SOUTHDOWN

by

J. A. MALLETT

THE chunky, low-set, meaty-carcassed Southdown is a popular breed wherever prime mutton and lamb are appreciated. Just as the Dishley Leicester was used to improve most of the British longwool breeds, so an infusion of Southdown blood has benefited the majority of the British shortwool sheep whose main role is meat production.

Like most of our British breeds, the precise origin of the Southdown is largely a matter of conjecture. The breed takes its name from the South Downs, a range of chalky hills extending across several counties in southern England—hills which are noted for their short, sweet grasses, but which, because of their exposure to the bleak winds from the English Channel during the winter periods, tended to develop hardy breeds of livestock.

The man whose breed improvement methods were largely responsible for the near-perfection of the present-day Southdown was John Ellman of Glynde Farm, Sussex.

Ellman, who was born in 1753, took over the management of his father's farm in 1780 and almost immediately commenced to improve the local sheep. These were described as being of the "common heath type"—long-legged, slender-boned, light-shouldered animals with speckled faces.

Unlike Robert Bakewell, who had already improved the Leicester sheep, Ellman seems to have been opposed to close inbreeding, but practised careful selection and rigorous culling to obtain the type of animal he had in mind.

Although the Southdown is primarily a meat breed, Ellman paid considerable attention to fleece improvement, as he maintained that good fleeces made the sheep better able to withstand the bleak winters. His argument was that a well-covered sheep was more comfortable, was a better feeder and a better meat-producer.

The Glynde sheep had heavier fleeces than their unimproved contemporaries, had better carcass conformation and matured earlier.

Apart from his sheep-breeding activities, John Ellman achieved fame as a successful breeder and exhibitor of Sussex cattle. He won many awards for farming, became a Deputy-Lieutenant for the county and refused offers of a baronetcy and later a peerage.

A "GENTLEMAN'S SHEEP"

As a result of the tremendous improvement wrought by Ellman, the Southdown achieved tremendous popularity and Glynde rams and ewes brought high prices. Members of the nobility and even Royalty were keen buyers and the Southdown became known as the "gentleman's sheep" as it was ideally suited to park life, and

produced mutton of a particularly high quality. The list of Southdown breeders in those days reads like a page from Debrett—and it is worth mentioning that the noted agriculturist, Coke of Holkham, bought 80 Glynde ewes in 1793.

Ellman's work was ably carried on by later breeders, notably Jonas Webb of Babraham who introduced the breed into Cambridgeshire and took many of the principal prizes at Britain's most famous shows in the "forties" of last century. Webb exhibited Southdowns at a great Parisian international show held under the auspices of Napoleon III and it is said that the Emperor paused to admire these sheep and asked whose they were.

"Yours, if you will accept them, your Majesty," said Webb, who was standing nearby. The gift was accepted and a present of solid silver plate was shortly afterwards sent from the Tuileries to Babraham.

WIDESPREAD POPULARITY

The Southdown has achieved immense popularity in many European countries, particularly in France, where it is widely used for crossing with the native French breeds to produce better carcasses of mutton. The U.S.A. formed a Southdown breed society in 1882 which was eight years before the Southdown Sheep Society of England came into being, and exportations of Southdown sheep have been made to South America, Mexico, Canada, Japan, the West Indies and of course to Australia and New Zealand, where it has played an important part in the fat lamb trade.

As the sire of export lambs from Longwool-Merino cross ewes, the Southdown has long been the most popular breed for producing a high percentage of first-grade carcasses. It appears to be the most suitable ram to use over the major portion of the lamb-producing areas of Australia, and Southdown-sired lambs rank highly on the Smithfield market.

Although in the old days the Southdown was renowned for its "four-year-old mutton," the modern representatives of the breed mature early and the lambs with their ideal proportions of fat to lean are excellently suited to the consumers' taste.

POINTS

Head—Wide, level between ears, with no sign of scur, horns or dark poll. Nostrils full and wide.

Face—Full, not too long from the eyes to the nose, and of one even mouse-colour, not approaching black or speckled; underjaw lighter in colour.

Eyes—Large, bright and prominent.

Ears—Of medium size and covered with short wool.

Neck—Wide at the base, strong and well set into the shoulders; throat clean.

Shoulders—Well-set and top level with the back. No depression behind blades.

Chest—Wide and deep.

Back—Level, with a wide, flat loin, and well covered with firm flesh. Compact in appearance.

Ribs—Well-sprung, and well ribbed up, thick through the heart, with fore and hind flanks fully developed.

Hindquarters—Rump wide and long and well turned, tail large and set on almost level with the chine.

Legs of Mutton (including thighs)—Should be full and well let down with a deep, wide twist.

Skin—Of a healthy bright pink, not inclined to blue.

Flesh—Even and firm-handling all over.

Legs—Short, straight, and of one even mouse-colour, and set on outside the body.

Carriage—Free and active.

Fleece—Of fine texture, great density and of sufficient length to staple, covering the whole body down to the knees and below the hocks and up to the cheeks, with a full foretop but no wool round the eyes or across the bridge of the nose. No black hairs on body.

As is to be expected in a meat breed, the wool of the Southdown is short (2½ to 3 in.) and light. It is among the finest of the British breed wools having a spinning count of 56/60 but lacks well-defined staples and is inclined to have a "mushy" tip. As it possesses poor felting qualities it is well adapted for the manufacture of flannels and hosiery.

Budding FRUIT TREES

By T. F. HERLIHY, Senior Horticultural Inspector

ALTHOUGH the principles of budding and grafting are basically the same—that is, the success depends upon the close contact of the cambium layers of both stock and scion—the operations are performed at different times of the year.

Grafting is carried out in the spring just prior to or immediately after sap movement whereas budding is performed during the summer months or when the stocks are in full growth.

Of the various methods used in propagating and reworking fruit trees, perhaps budding can be classed as one of the most interesting. This is mainly due to the fact that it is a quick and simple operation and can be performed with good results by persons who have a limited knowledge of the principles of plant growth.

Budding is the best and safest method to use when reworking stone fruits and citrus trees and particularly when propa-

Fig. 1.—Apple seedling stocks

gating young nursery trees of the above varieties.

It has also been successfully employed in changing over to another variety both young and old apple trees by inserting the buds into the base of new lateral growth after the tree had been skeletonised during the dormant season.

One of the main advantages that budding has over grafting is that it obviates the necessity to make large saw cuts when preparing the stocks and consequently lessens the chances of infection by spores of wood-rotting fungi.

TERMS USED

Budstick.—A shoot of the current year's growth from the parent tree, containing a number of mature buds.

Parent Tree.—The tree from which the budsticks are obtained.

Stock.—The rooted section of a tree or seedling in which the bud is inserted.

Cambium.—The growing tissue which is located between the bark and the wood of both the stock and budstick.

Rework.—To change the variety of a tree other than a seedling by budding or grafting.

SELECTION OF BUDSTICK

Budsticks containing well-developed mature buds are selected from the current year's growth. They can usually be found towards the outside edge of the tree or near the top where there is adequate light and air penetration for proper development. Budsticks taken from the interior of the tree are usually unsuitable and immature.

It is very important that the trees from which the budsticks are obtained are free from virus diseases or other disorders and that they produce fruit of good quality and true to the variety. When trees are in full growth the experienced grower or nurseryman can detect any variation in the normal growth and fruit characteristics of the parent trees and wherever a fault occurs the tree must be discarded as a source of budwood selection.

Avoid obtaining budwood from trees which show the following symptoms:

Variety	Remarks
Apple	Mottling of leaves (Apple Mosaic), Malformation of fruit, dimpling, etc.
Pears	Pitting and general malformation of fruit (Stony Pit).
Stone Fruits ..	Splitting and gumming of limbs, flattening of limb in split region (Bacterial Canker).
Citrus	Obtain buds only from old and healthy trees which have produced regular crops of good quality fruit. Virus diseases of citrus trees often do not show up until trees are aged.

The most suitable budsticks for citrus are the ones which are round, fairly well matured and about the thickness of a lead pencil. Young angular budsticks are undesirable.

TIME TO BUD

Citrus trees can be budded immediately after a growth period. In this State, growth periods take place during the spring and summer months, October-December and March-April.

In the nursery, buds which have been inserted during the spring and early summer months can be forced by loosening the tie and cutting off the portion of the stock above the bud, but not until the bud has shown unmistakable signs of having taken. As the subsequent new growth from the bud develops it must be tied periodically to a stake which previously should have been driven into the soil beside the young tree for this specific purpose.

Neglect of this important work invariably results in breakages at the union by wind.

Buds inserted during the March-April period should remain dormant until the following spring. To prevent the stem from constricting at the union however, it is important that the tie material be cut on the opposite side to the bud after the bud has taken in approximately three weeks. The top portion of the stock is not cut off until just prior to the flush of growth in the spring.

Apples, Pears and Stone Fruits are budded during February-March. In every instance the bark must lift away freely from the wood of the stock it is intended to bud and this is assisted by adequate

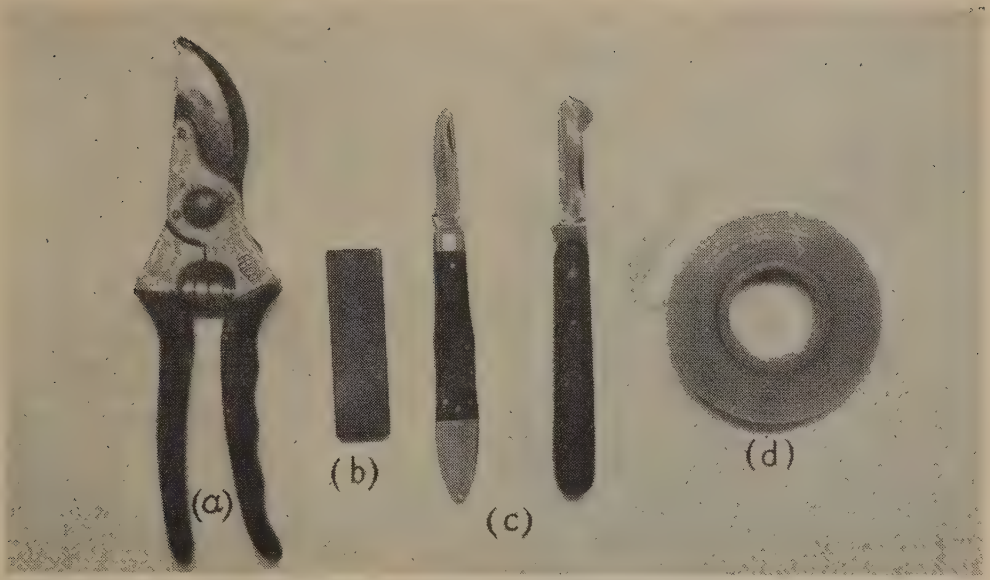

Fig. 2.—Budding equipment (a) Secateurs for removing budsticks from parent trees; (b) Pocket carborundum stone; (c) Two types of budding knives; (d) Roll of plastic tape for tying buds. Other suitable materials are rubber strips and raffia

watering approximately 24 hours before the operation commences. If the bark does not lift freely, damage to the cambium results and consequently failures are inevitable.

CARE OF BUDSTICKS

The care of budsticks differs considerably from that of scion wood for grafting which can be kept for a considerable period in cold storage or other suitable

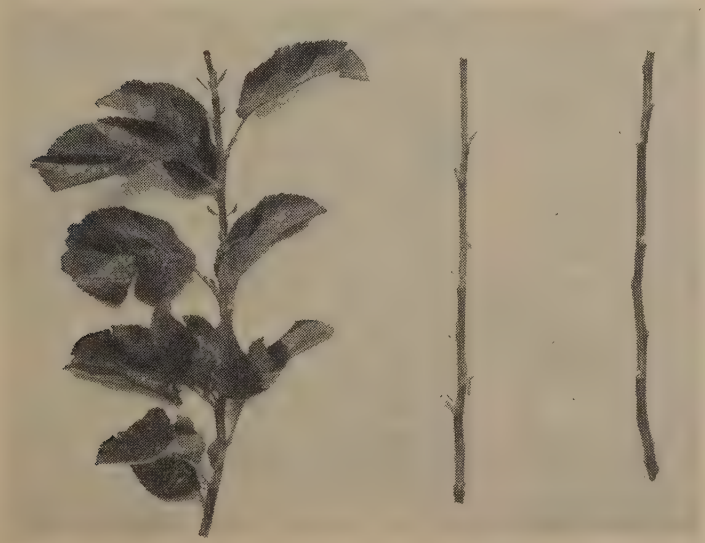

Fig. 3.—Budstick from current year's growth is shown on left. At centre, the budstick has been prepared, by removal of the leaves and trimming of terminal and basal portions. At right, the petioles have been purposely removed to show the prominent mature buds

Fig. 4.—Stocks with bottom leaves removed ready for budding

places. A good deal depends on the distance and number of trees involved as to whether or not budsticks should be kept any length of time.

Storage is unavoidable where long distances are involved, but usually the material is readily available close at hand and in such instances only sufficient for one day's work should be collected. Where storage is essential the budsticks should be wrapped in damp (not wet) newspaper and then placed in polythene bags, labelled and kept in the refrigerator.

In all instances the budsticks are prepared for use by immediately removing all leaves, cutting through the leaf stems or petioles and leaving just sufficient attached to the budsticks for the operator to use as a handle when inserting the bud into position on the stock.

The best buds are usually located in the middle of the budstick as those near the terminal and basal ends are immature and should be discarded.

A convenient and satisfactory method of keeping the budsticks fresh while the work is being carried out is to place them upright in a bucket containing a little water. This can be carried from tree to tree and placed in a convenient position in the shade and the budsticks removed as required.

Alternatively they may be wrapped in damp, but not wet, bags or cloth.

PREPARATION OF STOCK

There are various ways in which budding can be performed, but the most popular and simple method is the "T" or "inverted T" method. The incision is made at the base of the stock, by drawing the blade of the knife upwards for approximately one inch and then by a transverse or cross cut at the top or bottom. Care must be taken to see that only sufficient weight is on the knife blade to cut the bark so that it can be lifted freely from the wood and also to prevent any undue damage to the cambium layer.

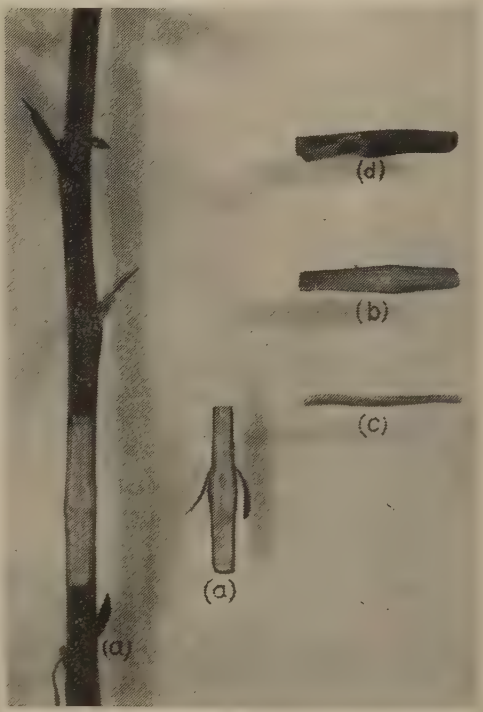

Fig. 5.—(a) Budstick with bud removed; (b) Reverse side of bud showing sliver of wood; (c) Sliver of wood removed; (d) Bud ready for insertion

Fig. 6.—(a) The T-cut made on the stock; (b) The bud inserted in the T-cut; (c) The bud tied with plastic tape

The bark at the junction of the cuts can be lifted slightly by a twist of the knife blade and the flaps are then opened by reversing the knife and sliding the bevelled bone end between the bark and wood.

CUTTING THE BUDS

The budstick is held with the buds facing the operator. It is supported by placing the index finger of the left hand directly under the bud it is intended to remove.

The bud is then cut from the budstick by a slicing movement of the blade, commencing approximately one inch below the bud and finishing approximately half an inch in front. The cut should be made deep enough to show a sliver of wood adhering to the bark when removed.

Experienced operators generally remove the sliver of wood, but good results can also be obtained if it is left in before insertion.

INSERTING THE BUD

The bud is then placed in position by holding the stem end attached to it with the thumb and fore-finger and sliding it between the bark and wood where the incision was made in the stock. Callusing will be assisted if the top end of the bud is placed hard up to the bark at the junction of the T cut.

The operation is completed by binding or wrapping the bud firmly with raffia, rubber strips, or plastic tape, leaving the eye of the bud exposed.

AFTERCARE

If the work has been carefully carried out a good union should result in approximately three weeks.

This is noticeable by the abscission of the petiole and the healthy appearance of the bud itself.

To prevent a restriction of the normal growth of the stock at the point of union, the blade of the knife is then drawn through the binding material on the opposite side to where the bud was inserted in the stocks, but the material is not removed.

The buds should then remain dormant until the following spring when that portion of the stock above the bud is removed allowing the bud to shoot and continue to grow.

The growing tips of vigorous young nursery trees are sometimes pinched out at approximately knee height to encourage the development of side shoots. When dug from the nursery rows these are then referred to as headed trees while those which have not been pinched back and have not developed side shoots are referred to as whips.

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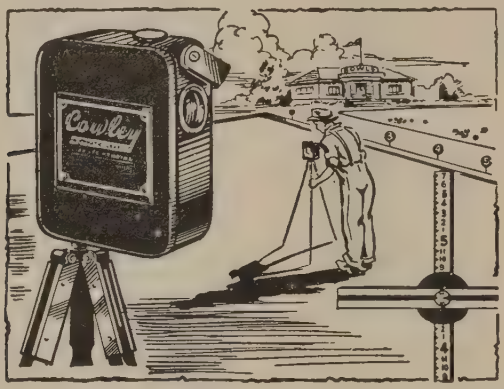

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GRASSHOPPERS AND LOCUSTS IN WESTERN AUSTRALIA

By C. F. H. JENKINS, M.A., Government Entomologist

GRASSHOPPERS and locusts are among the most ancient enemies of the farmer, for they figured prominently in Biblical times, and periodically throughout the ages have devastated crops in all parts of the world.

The term grasshopper covers a wide range of insects differing in size and habits, but characterised by the fact that they are vegetable feeders and have the hind legs especially developed for jumping. There are many different species of grasshoppers and locusts in Western Australia, but the difference between the two groups is not generally understood.

When conditions are suitable, the species usually termed locusts are much more gregarious or social in their habits than grasshoppers, and may undertake long migratory flights of several hundred miles.

In south-western Australia, although several species of true locusts occur, including a form of the world-famous migratory locust, conditions are not favourable to swarm development, and so fortunately only scattered individuals are encountered.

In addition to the distinction between locusts and grasshoppers which is based more upon habits than structure, there is also to be observed the difference between the short-horned grasshoppers (*Acridiidae*), and the long-horned grasshoppers (*Tettigoniidae*). The common names are more or less descriptive in that the antennae or feelers of the short-horned varieties are short and moderately broad, whereas in the long-horned group, the antennae may be almost hair-like in thickness and exceed the entire body of the insect in length.

THE SMALL PLAGUE GRASSHOPPER

(*Austroicetes cruciata* Sauss.)

The most important grasshopper in Western Australia is the small plague grasshopper of the drier wheatbelt districts. A general description of this pest and its habits may be regarded as typical of the other short-horned species.

Description.

The female measures a little over an inch in length, and is mottled brown in general coloration. The male is noticeably smaller than the female, and the forewings are mottled with light and dark brown. The most striking feature about the mature males is the bright yellow tinge on the body and legs. The hind wings in both sexes are clear and transparent.

Fig. 1.—The small plague grasshopper

Life History.

The grasshopper lays its eggs in almost any kind of soil providing it is compact and free from dense cover. The female bores into the ground by means of hardened chitinous valves situated at the end of the abdomen, at the same time exuding a frothy substance which acts as a lubricant and a lining to the egg pod.

About 20 eggs are laid in each pod, and it is characteristic of this species that a large group of males usually cluster around the ovipositing female. The eggs are yellowish white in colour and crescent-shaped. Egg laying takes place in the spring, and the eggs survive the summer to hatch about July or August, when sufficiently moistened by the winter rains.

When it first issues from the eggs, the young grasshopper moults or sheds a tight-fitting white skin, and is then capable of hopping about like its parent. At this stage however, it is rather smaller than a housefly and dark in colour. It feeds voraciously upon almost any available weeds, and increases in size by a series of moults, until maturity is reached about October.

Egg laying is then performed and the adults die.

The small plague grasshopper is not present in the wetter areas of the South-West, but its place there is filled by a number of other species of local importance.

FACTORS INFLUENCING THE OCCURRENCE OF PLAGUE OUTBREAKS IN WESTERN AUSTRALIA

A study of the climatic conditions for the plague years shows that the rainfall was light and this appears to have had a favourable influence upon the hatching and development of the insects. Another factor, however, has had a very important bearing upon the incidence of grasshoppers in these areas.

Following the financial depression of 1929, much land which had been normally kept under cultivation was allowed to lie idle. The effect of low prices was accentuated by a succession of drought years and this led to a general decline in agricultural activities in all districts, but more particulary in those areas where the margin of safety was least evident.

In the boom years preceding the depression, agriculture in Western Australia spread at a very rapid rate and extensive clearing took place in all parts of the wheatbelt. Grasshoppers had always been present in these areas in small numbers, but forest and scrub country was not favourable to their multiplication and feed was relatively scarce. The clearing of the country exposed vast areas suitable for egg laying and the grass which this land supported provided an ample food supply for the increasing insect population. As long as high prices and good seasons

stimulated farming activities, the menace of these potential breeding grounds was not apparent, and reserves, ring-barked areas, road sides, etc., were the only places where hoppers appeared. When, however, following depression and drought, abandoned farms became numerous, the grasshopper problem became one of paramount importance. The large areas of land left idle in most cases did not revert to bush again and were of such a nature, that the longer they were left untouched, the less herbage they supported, thus yearly increasing the breeding grounds available for the pest.

The problem as it exists in this State is by no means unique. The same species of grasshoppers constitutes a comparable problem in South Australia. Furthermore, the following quotation from the "Journal of Economic Entomology for 1940" shows that the same difficulties are being faced in the United States of America:—

> Agricultural conditions of recent years and recently adopted agricultural practices have greatly increased the amount of abandoned and reverted land in certain areas. Thus in North Dakota in 1938 there were more than four million acres of idle crop land listed among farms participating in the agricultural adjustment programme. This amounts to nearly 18 per cent. of the total crop land acreage of the state. This abandonment has occurred along with our extensive outbreaks of grasshoppers of recent years, so it is natural to suspect that the two facts might represent a cause and effect relationship.

OUTBREAKS OF THE SMALL PLAGUE GRASSHOPPERS IN WESTERN AUSTRALIA

As far back as August, 1922, swarms of grasshoppers were reported from Kununoppin, Nungarin and Merredin in the north-eastern wheatbelt and isolated outbreaks were recorded from these areas almost yearly up to 1934.

In 1935, quite a widespread plague was experienced and the pest increased annually until in 1937 almost the entire wheat areas were affected.

In order to combat the grasshopper trouble the policy was instituted in 1935 of making free poison bait available to farmers through local Road Boards, and in 1937 Government subsidies were commenced for the ploughing of grasshopper-infested areas. In recent years dieldrin spray has been provided instead of bran bait. Since the formation of the Agriculture Protection Board in 1951, grasshopper

Fig. 2.—Map showing the main grasshopper belt in Western Australia

control has come under the direction of this Board, and the Agriculture Protection Board Act provides that not less than £30,000 be provided each year for grasshopper control.

In recent years grasshopper activity has been rather depressed and this is reflected by the following figures.

GOVERNMENT EXPENDITURE ON GRASSHOPPER CONTROL

In the ten years 1944-53 the average annual expenditure on grasshopper con-

Fig. 3.—Typical grasshopper country in the north-eastern wheatbelt

trol was approximately £13,000 applied as follows:—

Financing ploughing of egg-laying areas—£10,000 approx.

Providing poison bait—£3,000 approx.

The average annual acreage ploughed was 66,000 acres and the heaviest single annual expenditure was in 1950 when £30,000 was spent in ploughing 140,000 acres and providing 170 tons of bait.

In the past five years the average annual expenditure on grasshopper control was approximately £6,000 applied as follows:—

Finance for the ploughing of egg-laying areas—£4,000 approx.

The provision of bait and spray concentrate—£2,000 approx.

The average annual acreage ploughed was 22,000 acres and the heaviest single annual expenditure was in 1954 when £11,000 was spent in ploughing 38,000 acres and providing 160 tons of bait.

This improvement in the grasshopper control position has been greatly helped by the change in agricultural practice in the outer wheatbelt in recent years. Mixed farming methods instead of the earlier dependence on wheat combined with more stable prices for agricultural products has led to the resumption and working of thousands of acres of previously abandoned country and a consequent reduction in grasshopper breeding. The grasshopper population also experienced a severe setback in the summer of 1955-56 when a prolonged and severe heatwave with many days over the century destroyed a high proportion of eggs and resulted in a very light hatching the following season.

The sudden decline in grasshopper numbers on the eastern fringe of the wheatbelt was attributed by many people, despite warnings to the contrary, entirely to artificial control measures, and the effects of climate were largely overlooked. This led to widespread apathy, as far as the grasshopper problem was concerned, and explains some of the surprise and concern now being expressed by many landholders following last year's grasshopper activity.

CONTROL MEASURES

Cultural Methods.

Heavy timber growth and a profusion of ground cover are unfavourable for the breeding of the small plague grasshopper and consequently the needless clearing and ring-barking of land in the grasshopper belt are to be deprecated. Every effort should be made to cultivate hard bare soil so as to destroy eggs already laid and to render the area unattractive to the next swarm of laying adults.

Summer cultivation with fixed tyne cultivators after egg laying is completed is quite effective and is favoured in certain districts where labour and other difficulties may reduce the amount of grasshopper ploughing possible during the seeding and fallowing periods.

Spraying

Dieldrin emulsion (25 per cent.)* should be applied at the rate of 2/5ths of a pint (8 fluid oz.) per acre. This is equivalent to 2 oz. of actual dieldrin per acre.

The concentrate should be diluted with water in accordance with the output of the spray pump, but from 5 to 10 gals. of spray liquid per acre is recommended when low volume ground equipment is used. Aerial applications of from ¼ gallon to 2 gals. per acre have been found effective.

Fig. 4.—Bait spreader with revolving plate and vanes for throwing poisoned bran

Where grasshoppers are invading crops or gardens from adjacent grass paddocks, as wide a barrier of grass as possible should be treated across the line of advance. At least a five-chain strip is recommended where flying insects are active. A portion of the crop face should also be treated.

For small scale use, as in the metropolitan home garden, infested areas should be sprayed with a 0.1 per cent. dieldrin mixture (= 1 part of 20 per cent. dieldrin to 200 parts of water).

Warning.

(1) Stock should be excluded for about a week from paddocks where general spraying has been carried out. Scattered treatments should provide little stock hazard.

(2) Do not spray vegetables or fruit within four weeks of harvesting.

Baiting.

Distribute broadcast amongst the hoppers the following poison bait:—

25 lb.—Bran.
1 lb.—Poison dust (10% BHC)**
2½ gallons (approx.)—Water.

This amount of bait is sufficient for one acre of ground. For home garden use the following quantities are suggested:—

6 lb.—Bran.
½ lb.—Poison bait (10% BHC)**
½ gallon (approx.)—Water.

Mix the BHC dust dry into the bran. Sufficient water should be gradually mixed in to produce a moist crumbly mash which will scatter in fine flakes when tossed into the air.

For maximum results the bait should be applied early on a bright calm morning. Bait is most effective against the hoppers when they are about three parts grown.

Warning.

Avoid the inhalation of the dust as much as possible when mixing. Also avoid lumpy bait as this may be a danger to stock.

OTHER GRASSHOPPERS AND LOCUSTS OF IMPORTANCE IN WESTERN AUSTRALIA

Although the small plague grasshopper is by far the most important grasshopper pest in Western Australia, quite a number of other species can become troublesome. Some of the commoner are briefly dealt with, and the control measures already outlined will be found applicable in one form or another to all the local species.

The Australian Plague Locust.
(*Chortoicetes terminifera* Walk.)

This locust is of primary importance in the Eastern States where it assumes plague

* Other concentrations available on the market are 15 per cent. and 20 per cent. concentrations. These should be used at the rate of 2/3rds of a pint and ½ pint respectively per acre.

** If 10 per cent. BHC (Benzene-hexachloride is not available, Paris Green or Arsenite of Soda may be used but are slower in action.

Fig. 5.—The Australian plague locust

proportions. In Western Australia it is numerous in the summer months, often attacking vegetables and garden flowers, but it never masses into true migratory swarms. It is larger than the species already described, and may be brownish or green in colour. The extremities of the otherwise clear hind wings are tipped with black.

Its breeding habits are generally similar to those of the previous species, but several generations may occur in one year if weather conditions are suitable.

The Wingless Grasshopper.
(*Phaulacridium vittatum* Sjost.)

This is a small grasshopper, uniform grey or brown in colour, and with many individuals almost wingless.

It is common in many districts around Perth and the lower South-West and unlike the grasshopper of the wheatbelt, breeds quite freely in sand. Damage is sometimes done to market gardens, flower gardens and fruit trees, but the plagues are always strictly local, as only a few of the insects ever develop wings, even when fully mature.

The Yellow Winged Locust.
(*Gastrimargus musicus* Fabr.)

This species is a large thick-set grasshopper, easily recognised by the conspicuous black and yellow colouring of the hind wings.

The favourite haunts of this insect are grassy paddocks supporting a wealth of couch or paspalum. On this account, it is commonly seen during the summer months in the Harvey-Waroona irrigation districts and along river flats.

The yellow winged locust is an important pest in the summer rainfall areas of the north and periodic plagues occur during

Fig. 6.—The long-horned grasshopper

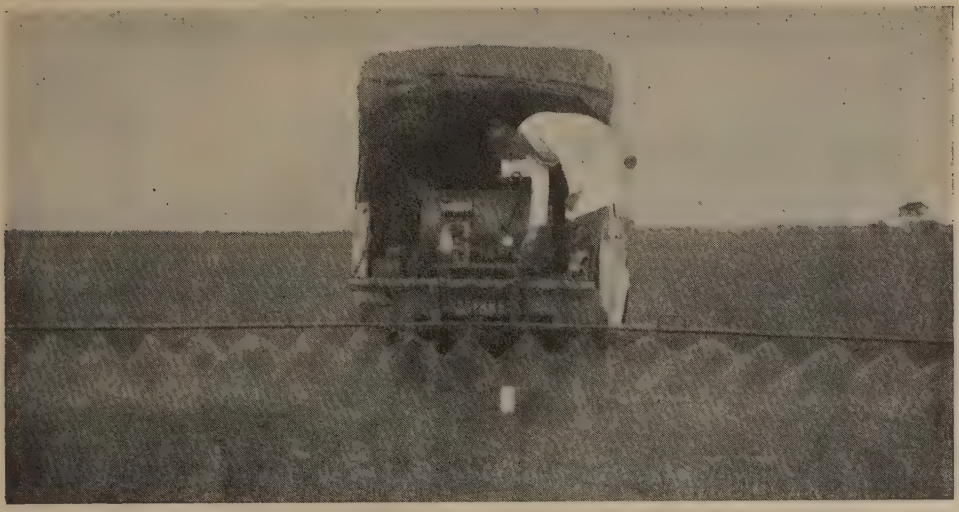

Fig. 7.—Low-volume boom spray applying insecticides.

the summer months to devastate homestead gardens and other cultivated produce.

The Spur-throated Locust.
(*Austracris guttulosa* Walk).

This is a large brown locust about 2½ inches in length which is fairly common in many parts of the South-West but never in plague swarms. Like the yellow-winged locust and the migratory locust, however, it swarms in the more northern regions and occasionally has invaded the banana plantations at Carnarvon. The habits of this locust differ greatly from those of the wheatbelt grasshopper as the adult is a much longer-lived insect.

Egg laying, which takes place at night, occurs about December or January and the eggs hatch soon after.

The winged adults feed voraciously on a wide range of plants including eucalypts, bananas and citrus. The winter months are passed in the adult stage, when the insects sometimes cluster in large masses in the tree tops almost like swarms of bees.

Long-horned Grasshoppers.

The long-horned grasshoppers differ considerably in habits from the short-horned species and are of much less economic importance.

The ovipositor or egg laying apparatus of the female "long-horned" is usually long and sword-like, although not invariably so. The eggs are usually placed in rows along the edges of leaves, but some species lay them in the ground.

The long-horned grasshoppers, although often numerous enough to cause annoyance, cannot be regarded as serious pests in this State. They may cause damage to ripening fruit and being usually more arboreal in their habits than the "short-horns" are less susceptible than the latter to normal measures.

Dieldrin sprays are effective against these species however and may be used to treat fruit trees and shrubs or other foliage harbouring the insects. Trees carrying ripe fruit should not be sprayed, as dieldrin should not be applied to edible crops within four weeks of harvesting.

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Tobacco

SEED-BED MANAGEMENT

by A. E. BAKER, Tobacco Adviser

A SUCCESSFUL tobacco crop depends initially on an ample supply of well-grown, disease-free seedlings available early in the planting season. If planting is held up due to a poor supply of seedlings, the resulting crop will not be grown in the most favourable part of the season. Late-grown crops nearly always give low returns.

In determining the site for seed-beds, the availability of water should be considered. A good supply of water which can be used from a hose is essential for the production of tobacco seedlings.

Seed-beds should face approximately north-east so as to benefit from the greatest amount of sunshine. Protection from prevailing southerly and westerly winds is also an advantage in keeping the soil warm.

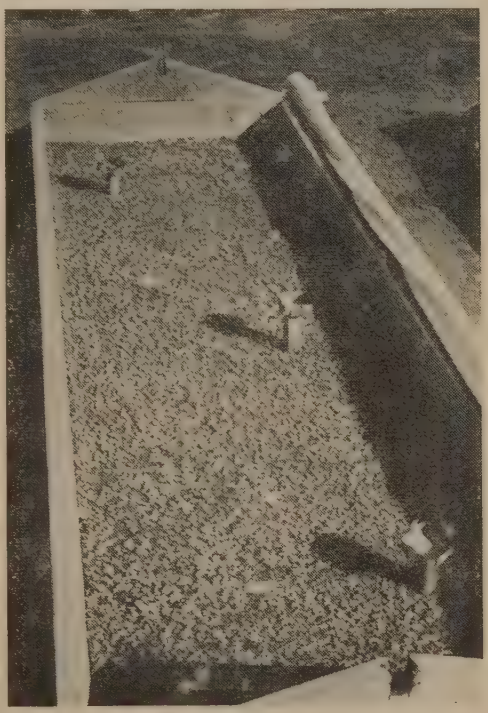
The desirable soil for seed-beds is a friable sandy loam; most tobacco soils are suitable for this purpose.

Most seed-beds are constructed with timber frames about 16 ft. in length and 3½ ft. in width. Larger sized beds may be used though anything over 4 ft. in width is inconvenient to reach over when applying benzol and handling the plants.

Unbleached calico covers fitted to wooden or pipe rollers are used to confine the benzol vapour and to protect the seedlings from frost or heavy rain.

SOIL PREPARATION

It is an advantage to treat the soil for the control of weeds, nematodes and diseases prior to sowing. One of the most effective agents for controlling weeds, nematodes and diseases is the gas, methyl bromide. This chemical can be purchased in 1 lb. tins and is used at the rate of 1 lb. per 100 square feet of seed-bed area. Thus two 16 ft. x 3 ft. beds could be treated with one pound of methyl bromide. To apply this gas to the soil a plastic sheet is laid over the seed-bed frame and the edges of the sheet are covered with soil in order to make a gas-tight seal. By



A 9 ft. x 3 ft. seed-bed with centre ridge-pole removed to show good even germination of seedlings. Note that few benzol tins are used in the early stages of seedling growth

means of a rubber tube which is passed under the plastic sheet and an adaptor which fits onto the can of methyl bromide, the gas is released under the cover.

The plastic cover, which holds the gas in contact with the soil, is left in place for 24 hours if the weather is fine and the soil is not too wet, or for 48 hours if the weather is cold and the soil is over-moist. At the end of this period, the sheet is removed and the bed can be planted after 48 hours exposure to the air. The one plastic cover may be used in rotation for treating all the beds.

Higher rates than 1 lb. of methyl bromide per 100 square ft. of bed may be used if the beds sizes and plastic sheet sizes do not work out evenly. The range between 1 lb. of methyl bromide per 100 square ft. and 1 lb. per 50 square ft. is satisfactory except that the higher rates are more expensive.

If care is taken to see that there are no sharp corners or nails on the seed-bed frames which would puncture the plastic sheet, such a sheet should last for several seasons.

Warning.—Methyl bromide is a poisonous gas and should be handled carefully. Do not breathe the vapours. Each can of methyl bromide contains tear gas which causes the eyes to burn, and this serves to warn of gas leakage during storing or handling. Be sure to read directions on the can before applying methyl bromide.

Other seed-bed treatments which are sometimes used are formalin and allyl alcohol. Formalin is useful for the control of soil-borne diseases but controls weeds and nematodes only to a limited extent. Allyl alcohol is only useful for the control of weeds.

FERTILISER

Many growers in the past have used far too much fertiliser on seed-beds and this has caused widespread seedling injury.

Before planting the beds, a dressing of 1½ lb. of low potash (5.7 per cent.) tobacco fertiliser or potato manure "B" should be applied per square yard of soil. The correct quantity of fertiliser per bed should be weighed out so as to ensure that the right amount is applied. Thus a 16 ft. x 3½ ft. bed having an approximate area of six square yards will require 9 lb. of fertiliser.

The fertiliser is spread evenly over the surface of the bed and mixed into the top two or three inches of the soil. Deep digging in of this fertiliser should be avoided otherwise the seedling roots may not reach the fertiliser and the resulting growth will be poor.

SEEDING

As a result of poor germinations in the past, growers continue to plant tobacco seed at very heavy rates in order to overcome this trouble. Poor germination has usually been caused by the use of too much fertiliser or by dry soil conditions or a combination of both these factors.

If seed-beds are managed properly, a good stand of plants may be obtained by sowing not more than 1 oz. of tobacco seed per 100 square yards. With a bed 16 ft. x 3½ ft. having an area of 6 square yards, a **level teaspoon** of seed is sufficient. This seed is mixed with clean sand or fine wood ash and sprinkled evenly over the whole bed. The back of a rake may be used to press the seed into the soil and to firm down the top of the soil.

It is an advantage to spread a thin layer —no more than ⅛ in. thick—of clean coarse creek-bed sand over the surface of the bed to cover the seed. This coarse sand protects the germinating seed from drying out and also prevents it from being washed out by heavy watering. It is worth remembering that sand which is used to mix with the seed for sowing and sand used for covering the seed should be treated with methyl bromide, otherwise weeds and disease organisms may be introduced into the clean beds. A small heap of sand for this purpose may be placed next to one of the beds and treated with methyl bromide at the same time as the bed is treated.

CARE OF SEED-BEDS

Watering.

Probably the most common cause of failure with tobacco seed-beds is in not keeping the soil surface sufficiently moist during the germination period.

As it takes approximately three weeks for tobacco seed to germinate in July at Manjimup, the soil surface must be kept moist during the whole of that period. In fine windy weather, frequent light waterings by hand hose will be necessary.

Benzol.

In the Manjimup district, blue mould seldom attacks seedlings earlier than three weeks after germinating. When the seedling plants are about the size of a threepenny piece, benzol should be used in the beds every night.

The evaporating tins used to hold the benzol should not be deeper than one inch and about 3 to 4 in. wide. The full treatment should consist of one square inch of benzol surface to every 100 square inches of seed bed area. Thus a 16 ft. x 3½ ft. bed will have an area of 8,064 square inches. Divided by 100, this equals 80 square inches of benzol surface required.

If three-inch diameter round tins are used, each will have an area of seven square inches. Then 80 divided by 7 indicates that 11 tins are required for each seed-bed.

In the early stages, when the seedlings are young, they should not be subjected to the full benzol treatment otherwise injury will occur. Begin with half the number of tins per bed, and gradually increase the number as the seedlings grow. Benzol in the liquid state is fatal to seedlings and the greatest care should be exercised to prevent spilling or splashing when the tins are being filled.

Diseases.

In addition to blue mould, the next most common disease occurring in seed-beds is damping-off. This fungal disease attacks the seedlings at ground level and may also be associated with various root-rotting organisms. One of the most common causes of this disease is overcrowding of seedlings due to too much seed being planted. By fumigating the soil prior to planting; by not sowing the seed too heavily, and by allowing the beds to remain open to the sun and air during the growth of the seedlings, much of the risk of damping-off disease will be overcome.

A further operation in the prevention of damping-off or in the control of the disease if it does occur, is the use of Cheshunt mixture. One ounce of Cheshunt mixture is dissolved in two gallons of water and this solution is watered onto the beds. This solution should be washed off the leaves with clean water in order to prevent burning. Cheshunt mixture may be used twice weekly if damping-off is prevalent in the seed-beds.

As Cheshunt solution attacks galvanised watering cans, it is advisable to use a copper or plastic watering can for the application of this chemical.

Mosaic disease is frequently present in manufactured tobacco so that people who smoke often infect seedlings with their hands. Before any seedlings are handled or pulled, the hands should be thoroughly washed with soap and water. Do not smoke whilst handling or pulling seedlings.

GROWTH OF SEEDLINGS

If seedlings are backward in growth or inclined to be yellow, they may be helped with some liquid manure. For this purpose a small handful of nitrate of soda or sulphate of ammonia mixed in four gallons of water may be watered on to the beds. Immediately after this treatment, the beds should be watered with plain water so as to wash the fertiliser off the leaves. Urea may be used instead of nitrate of soda or sulphate of ammonia, to stimulate growth of the seedlings. As urea has twice the quantity of nitrogen as these other fertilisers, only half the quantity should be used at a time. A heaped tablespoon of urea in four gallons of water should be sufficient.

Seedlings should be hardened off by reducing the watering during the week or so before planting out in the field. By allowing the seedlings to wilt a little in the beds at this stage, they will be toughened up and then will be more able to withstand the shock of transplanting in the field.

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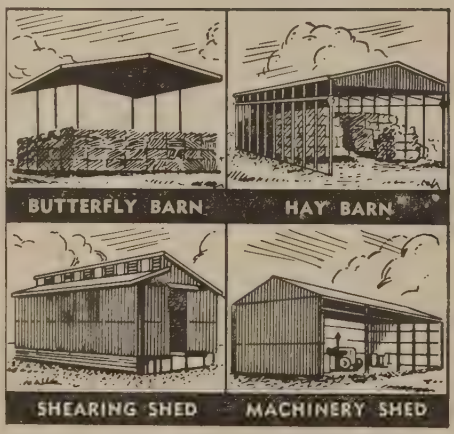

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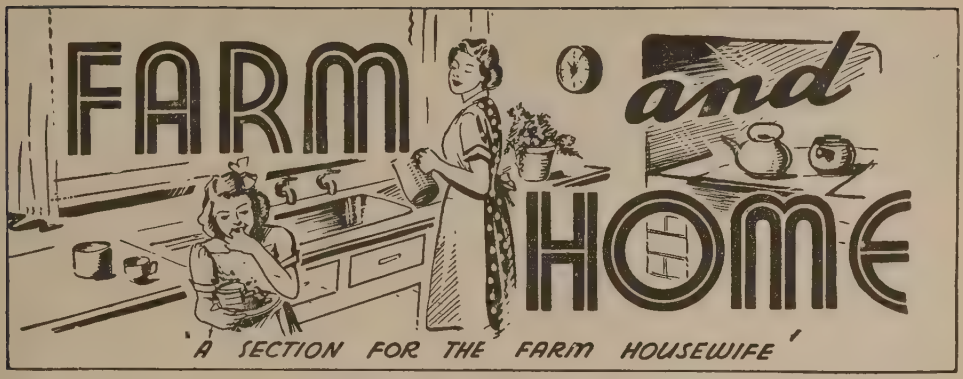

Take Care of That Woodwork

By HELEN M. GLOSTER

"I think that I shall never see a poem lovely as a tree."

IN these oft-quoted lines, Joyce Kilmer expressed a thought which many of us may have cherished. Most of us are tree-lovers and few people can witness the felling of a forest giant without a pang of regret. It is consoling to reflect however that "tree-butchery"—the wasteful exploitation of forest resources—is largely a thing of the past.

In most countries of the world, forestry is a highly-specialised profession aimed at preserving our forests for all time as the source of successive "crops" of timber. The removal of mature and over-mature trees is scientifically undertaken to give younger growth the best possible chance of satisfactory development, and reforestation programmes are planned to ensure adequate supplies of timber for future generations.

We, as users of timber in many forms can do much to ensure that its beauty and usefulness are maintained for many years.

Good timber is worthy of care. Much of it can give good service for centuries—a fact that has been demonstrated on numerous occasions by historic buildings and antique furniture.

HARDWOOD HERITAGE

Here in Western Australia we are fortunate in possessing hardwoods which are the envy of other countries throughout the world. Visitors from overseas are amazed to see these splendid timbers being used for many purposes for which softwoods are generally employed in other lands.

Many of our timbers are intrinsically beautiful and are seen at their best when merely polished or treated with clear varnish; processes which enhance the attractive colour and graining while at the same time aiding in preservation.

Where the natural wood is too dark to suit the general scheme of decoration, suitable paints may be used. Be sure to use one of the well-known brands and follow the maker's recommendations regarding primers, undercoats, etc. Steer clear of cheap paints—they usually prove costly in the long run.

OILING WOOD FLOORS

Hardwood floors should be sanded to a smooth surface, swept perfectly clean and then given a generous dressing of raw linseed oil which should be allowed to soak well into the wood fibres.

In the case of external verandahs, raw linseed oil is still the best dressing, but where the cost is a deciding factor, many people use sump oil thinned down with kerosene. Do not be too liberal with this dressing, otherwise the surface will have an unsightly coating of oil and dust.

POLISHING

A good polish enhances the appearance of a floor by emphasising the beauty of the wood grain. It also preserves the wood and makes subsequent house-cleaning much easier.

There are many excellent proprietary polishes, most of which include wax, linseed oil and turpentine in their list of ingredients. Many housewives have their own pet recipes. A friend of mine uses equal parts of raw linseed oil, turpentine and vinegar for jarrah floors and certainly achieves good results with this mixture—plus plenty of "elbow-grease," applied in these days by an electric polisher.

Cheap polishes are seldom economical as they are made from inferior ingredients. This home-made floor cream is reasonably inexpensive and produces an excellent shine.

2 oz. Beeswax and 2 oz. Paraffin wax (or 4 oz. Beeswax).

½ pint Turpentine.

½ pint boiling water.

1 tablespoon Cloudy Ammonia.

Note.—The best turpentine is the vegetable oil obtained from pine-trees. So-called "mineral turpentine" is a by-product of the petroleum industry and is less effective in polishes.

Method.

1. Shred the wax into a tin or jar with a lid, add the turpentine, and leave covered in a cool place for about a week. If extra heat is needed to dissolve the wax, stand the container in near boiling water.

Do not bring near fire or flame as turpentine is highly inflammable.

2. Stir the half-pint of boiling water into the turpentine-wax mixture.

3. Add the cloudy ammonia gradually and beat until the mixture is thick and creamy. The quantity of ammonia needed may vary slightly according to the strength of the preparation.

4. Store in a closed jar or tin for use as required.

ON APPLYING POLISH

Make sure that the floor is perfectly clean and that the initial oil dressing has been thoroughly absorbed. Sweep thoroughly using a small brush to remove dust from corners. It should not be necessary to wash the floor, but grease-stains, etc., should be removed by the use of turpentine or methylated spirit.

Apply polish sparingly, rubbing it well into the boards, and then polish with a soft cloth or soft polishing brush until the shine appears.

Avoid heavy applications of polish in the corners and on other little-used portions of the floor.

FURNITURE POLISH

A cheap and effective polish for furniture may be made by mixing the following ingredients:—

2 parts raw linseed oil.

2 parts turpentine.

1 part methylated spirit.

1 part vinegar.

This may be bottled and will keep indefinitely. Shake well before using. Besides preserving and beautifying the woodwork, this polish will discourage attacks by insects.

Before applying, see that the furniture is free from dust and spillage stains. If necessary, wash with warm water to which a tablespoonful of vinegar is added to each quart of water.

Dry thoroughly before applying polish with a soft rag and here again, apply the polish sparingly but be liberal with the "elbow grease."

Old velvet or velveteen garments can be cut up to make excellent polishing cloths for furniture. Do most of the polishing by rubbing in the same direction as the grain of the wood.

PAINTED AND UNPAINTED WOODWORK

Paintwork should be dusted and wiped thoroughly with a soft cloth dipped in warm soapy water and wrung out. Stains should be *lightly* rubbed with one of the proprietary "no-scratch" cleaners. Rinse with clear water and wipe dry.

Plain white pine has largely been superseded in modern homes by the various labour-saving and attractively colourful materials such as laminex and formica.

If you wish to keep white pine woodwork attractive use clean cold or lukewarm water and one of the well-known proprietory cleansers—hot water sends grease deep into the wood fibres.

Scrub thoroughly, working along the grain of the wood. Rinse in clean cold water and dry as quickly as possible. Remember that wood allowed to absorb too much water frequently warps in drying.

Fences should follow Natural Features

Fencing new land? Subdivide it into large natural areas for clearing and developing by fencing along creeks or rocky ridges. Later, when the topography and possible water supplies are better known, the subdivision into smaller paddocks can be planned without inconvenience caused by existing fences. The trees in this photograph mark the course of a large creek and the farmer who owns the land has erected his fence along this natural waterway where it does not interfere with cultivation.

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WESTERN AUSTRALIAN GOVERNMENT RAILWAYS

A Spraying Guide

FOR THE

CONTROL OF PESTS

AND

DISEASES OF FRUIT TREES

THE following guide for the spraying of fruit trees has been prepared as a ready reference for fruit growers and as a seasonal reminder of control measures necessary to deal with orchard pests and diseases. The charts have been kept as brief as possible consistent with supplying details of recommended materials, concentrations and time of application, and growers should consult Departmental leaflets or Departmental officers for more detailed information.

The choice of the right materials and application at the optimum time are all important, but the use of efficient spray equipment and the effective application by operators conversant with the problem in hand are also essential for successful control.

Growers are advised to follow a carefully-prepared spray schedule designed to deal with pests and diseases likely to be encountered, rather than wait until heavy infections occur when it is often too late to apply effective control measures.

COMBINATIONS OF SPRAY MATERIALS

Certain combinations of insecticides and fungicides can be successfully applied in a single spray. This is useful where more than one pest has to be dealt with at one time. However some mixtures should not be used as they may cause damage to the trees or the effectiveness of one or both of the materials may be reduced or even destroyed. Before combining any two spray materials, reference should be made to the Compatibility Chart included in this publication. The combinations on the chart marked as incompatible should not be mixed. Mixtures of questionable compatibility may be satisfactory under certain conditions but are not recommended for general use. All combinations shown in white may be safely used. This chart only applies to combinations of two materials used at normal concentrations. Mixing more than two materials or exceeding the normal concentrations may produce further incompatibilities. Growers requiring information on the compatibility of materials not mentioned on this chart are advised to contact the Department of Agriculture.

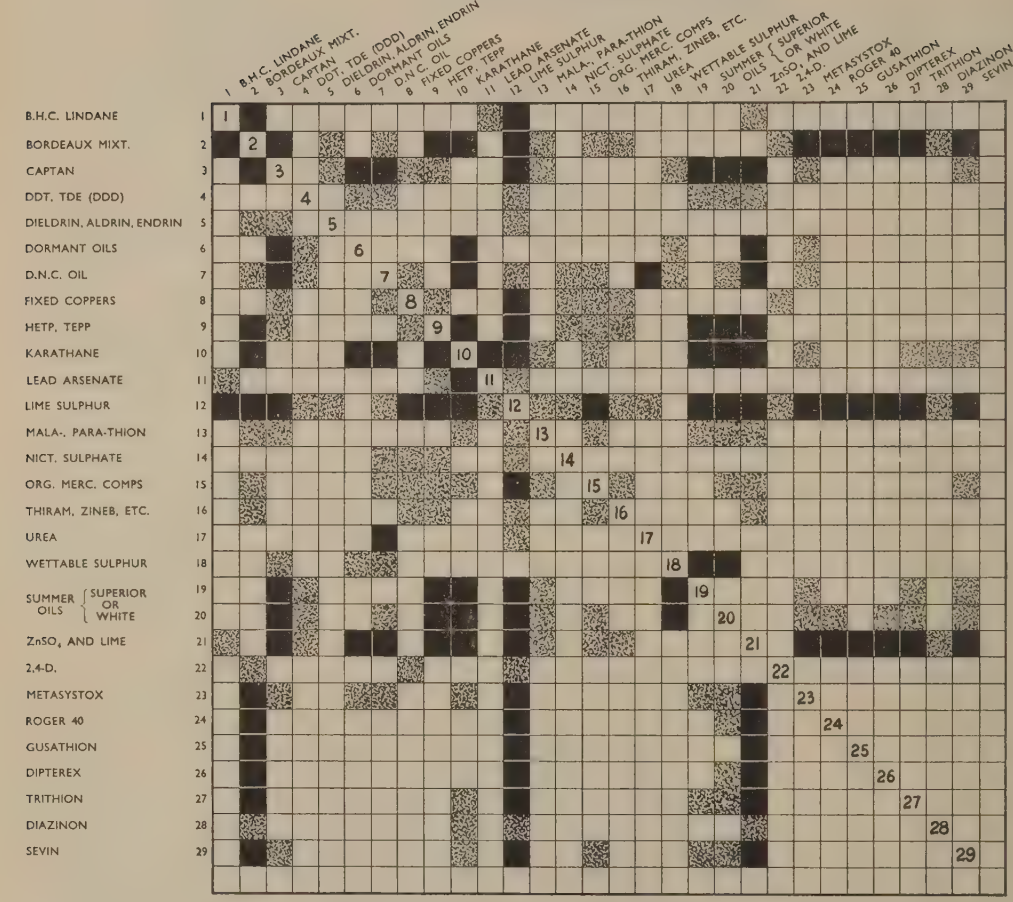
DILUTION OF CONCENTRATES

In many instances it is possible to express the concentration of the spray as the number of lb., gallons, etc., required to make 100 gallons of spray mixture. However, where the percentage of the active ingredient in the concentrate material varies with various manufacturers, this is not possible. To enable growers to work out the amount of concentrate required per 100 gallons of the recommended spray a Spray Dilution Table has been included at the end of this leaflet. The concentration of the proprietary line is given in the first vertical column and the required concentration of the final spray mixtures is shown along the top. The method of using the table is as follows:—

> Supposing the material to be used is a 25 per cent. concentrate and the spray required is 0.1 per cent., then by following across the table from 25 per cent. until the column headed 0.1 per cent. is reached, it is found that 3¼ pints of 25 per cent. concentrate

WESTERN AUSTRALIAN DEPARTMENT OF AGRICULTURE

COMPATIBILITY CHART



KEY—

- Not compatible. Should be applied separately, in most cases with long intervals between applications.
- Questionable compatibility. Mixtures must be used with caution and are not recommended.
- Fully compatible, and may be mixed together for application.

NOTE—*If the need arises to use materials not included in this chart, growers are advised to contact the Department of Agriculture.*

The chart applies only to two-material spray combinations. Where three or more materials are mixed together, further incompatibilities may occur.

If the recommended concentrations are exceeded, further incompatibilities may occur.

Incompatibility may be due to—

(1) *Reduced effectiveness of one or both materials.*

(2) *Plant damage resulting from the combinations of two materials which would not occur if either material was used separately.*

(3) *Curds or precipitate resulting from the combination of two materials causing nozzles to be clogged or failure of the spray to disperse properly.*

are required to make up 100 gallons of 0.1 per cent. spray. A similar procedure is adopted for other concentrates and final dilutions.

SIMPLE STANDARD NAMES

Many of the newer insecticides and fungicides are so complex in composition that simple standard names have been adopted throughout the world to represent their chemical constituents. For example ziram is the simple standard name for zinc dimethyl dithiocarbamate and all proprietary fungicides containing this compound are referred to as ziram-type fungicides.

These simple standard names, which have been used throughout the charts are displayed on trade labels in conjunction with the chemical constituents so that by reference to the label, growers can ensure that any particular proprietary line of insecticide or fungicide is of the required type.

PRECAUTIONS IN HANDLING SPRAY MATERIALS

Many pesticides introduced in recent years are toxic to humans, some much more so than others and growers should comply strictly with any safety precautions recommended by the manufacturers.

Instances of highly dangerous materials are—Parathion, HETP, Gusathion and Dieldrin and these should be handled with special care. Protective clothing should be worn and steps taken to see that the concentrate does not come into contact with any part of the body. Operators should not inhale the spray mist or allow their clothing to become saturated with the spray. Signs of headaches, giddiness or nausea should be dealt with promptly and medical aid sought.

DNC, DDT, BHC, Diazinon, Metasystox, Trithion, Nicotine Sulphate, Arsenate of Lead and Phenyl mercury compounds are others which must be handled carefully.

Some of the newer organic fungicides may also cause skin irritation if handled carelessly and for this reason contact especially with the concentrated materials should be avoided.

FORWARDING SPECIMENS

Correct diagnosis of the trouble is essential for satisfactory control. Where the identity of an insect pest or disease is in doubt, a local Departmental Field Officer should be consulted or specimens forwarded to the Department of Agriculture, South Perth. If specimens are forwarded, it is important that they arrive in good condition. In the case of insects, wrap carefully in tissue paper and pack firmly in a cardboard box. They should not be forwarded in airtight containers.

Specimens for disease diagnosis should be forwarded as soon as possible after collection. Leaves should be pressed between sheets of cardboard or blotting paper; fruits or twigs should be wrapped in newspaper and packed in a suitable container to prevent damage in transit. In the dry summer months the freshness of specimens may be maintained on transit by using moist newspaper for the inner wrappings. However, this is inadvisable in the cooler months as the moisture will encourage secondary moulds. If whole plants are submitted, enclose the roots and adhering soil in plastic and wrap the remainder in newspaper.

SPRAY DILUTION TABLE

The following table gives the quantity of Concentrate to be mixed with 100 gallons of water to produce the required dilution

Concentration of Proprietary Insecticide	Concentration Required for Spraying							
	2%	1%	0·5%	0·2%	0·1%	0·05%	0·02%	0·01%
10%	25 gal.	11 gal.	5 gal.	2 gal.	1 gal.	4 pts.	32 oz.	16 oz.
15%	15 gal.	7 gal.	3½ gal.	1¼ gal.	5 pts.	2¾ pts.	20 oz.	11 oz.
20%	11 gal.	5 gal.	2½ gal.	1 gal.	4 pts.	2 pts.	16 oz.	8 oz.
25%	9 gal.	4 gal.	2 gal.	6½ pts.	3½ pts.	1¼ pts.	13 oz.	6 oz.
30%	7 gal.	3½ gal.	1¾ gal.	5 pts.	2¾ pts.	1¼ pts.	11 oz.	5 oz.
40%	5 gal.	2½ gal.	1¼ gal.	4 pts.	2 pts.	1 pt.	8 oz.	4 oz.
50%	4 gal.	2 gal.	1 gal.	3¼ pts.	1½ pts.	¾ pt.	6 oz.	3 oz.
80%	2½ gal.	1¼ gal.	5 pts.	2 pts.	1 pt.	½ pt.	4 oz.	2 oz.

Note.—1 gallon = 8 pints ; 1 pint = 20 oz.

NUTRITIONAL SPRAYS FOR FRUIT TREES

Deficiency	Spray Material	Concentration	Time of Application	Remarks
		CITRUS		
Copper	Bordeaux mixture or fixed coppers (copper oxychloride)	8 : 8 : 100 Manker's recommendation	Spring or Autumn	Normal Brown Rot Sprays are effective.
Zinc	Zinc sulphate Hydrated Lime Water	10 lb. 5 lb. 100 gallons	Late Spring or Autumn	If used regularly as a maintenance spray use half concentration, late Spring.
Manganese	Manganese sulphate Water	5–10 lb. 100 gallons	Late Spring or Autumn	Under certain conditions the higher concentration could cause slight damage.
Combined Copper, Zinc and Manganese	Copper Sulphate Zinc Sulphate Manganese Sulphate Hydrated Lime Water	3 lb. 3 lb. 5 lb. 8 lb. 100 gallons	Late Spring	Any two of these trace elements may be combined. Reduce Hydrated Lime proportionately :—2½ lb. lime for Manganese, 3 lb. for copper, 1½ lb. for Zinc.
Magnesium	Epsom Salts Water	20 lb. 100 gallons	Late Spring or early Autumn	This spray may need to be repeated, *e.g.*, twice in Spring and once in Autumn.
		DECIDUOUS FRUIT		
Copper	Copper Sulphate Water *or* Bordeaux Mixture	20 lb. 100 gallons 4 : 4 : 100	Dormant November	 Can russet fruit. Best confined to young trees.
Zinc	Zinc Sulphate Water	20 lb. 100 gallons	Dormant	
Manganese	Manganese Sulphate Water *or* Manganese Sulphate Water	40 lb. 100 gallons 5–10 lb. 100 gallons	Dormant November	 Under certain conditions the higher concentrations could cause slight damage.
Magnesium	Epsom Salts Water	20 lb. 100 gallons	Late Spring or early Autumn	This spray may need to be repeated, *e.g.*, twice in Spring and once in Autumn.

FRUIT TREE SPRAY CHART

Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		APPLES		
Apple Curculio	Dieldrin	0·1–0·5% (*see* spray dilution chart)	Just before emergence of the beetles—Early December	Use higher concentrations early in the season. Apply as a butt spray. Use 1 quart per tree. A dieldrin foliage spray (0·05%) is also effective but may cause a build-up of Bryobia mite *See* precautions for using Dieldrin.
Apple Leaf Hopper (Jassid)	Metasystox *or* D.D.T. *or* Summer Oil Nicotine Sulphate	16 oz. per 100 gallons 0·1% (½ gal. 20% D.D.T. to 100 gallons of water) 1 to 1½ gallons 1 pint ; water 100 gallons	Early November or as required Early November Early November	 Spray when first winged jassids appear. Usually the D.D.T. Looper spray is adequate. A build-up of the Bryobia mite may result from the use of D.D.T. Spray when first winged Jassids appear. Two sprays may be required. Can be combined with Arsenate of Lead.
Fruit Fly	Malathion *or* Soldium Fluosilicate Dipterex	4 oz. Malathion 50% ; 2–4 oz. Protein hydrolysate : 4 gallons water *or* 4 oz. Malathion 50% ; 2½ lb. Sugar ; 4 gallons water Use a recognised proprietary foliage bait or the following :—1 oz. Sod. Fluosilicate, 2½ lb. Sugar, 4 gallons water 1 pint in 30–60 gallons	At weekly intervals from 6 weeks before fruit is ripe until 2 weeks after harvest 14 days and again 3 days before harvest	Spray or splash the bait onto the foliage. Observe orchard hygiene—destroy all fallen and infested fruit. *See* Departmental leaflet on Fruit Fly. Use in conjunction with foliage baiting. Use the higher concentration for first spray if infestation is severe.
Looper Caterpillar and Spring Beetle	D.D.T. Arsenate of Lead	0·1% (¼ gallon 20% D.D.T. to 100 gallons of water Arsenate of Lead powder 2 lb. ; White Oil, 1 gallon ; 100 gallons	October or November October or November	D.D.T. gives excellent control but may cause a build-up of Bryobia mite. This spray will help control apple Jassid. The spray gives good control and does not encourage a build-up of Bryobia mite. Avoid spraying later than December to prevent spray residue on the fruit.

Fruit Tree Spray Chart—continued

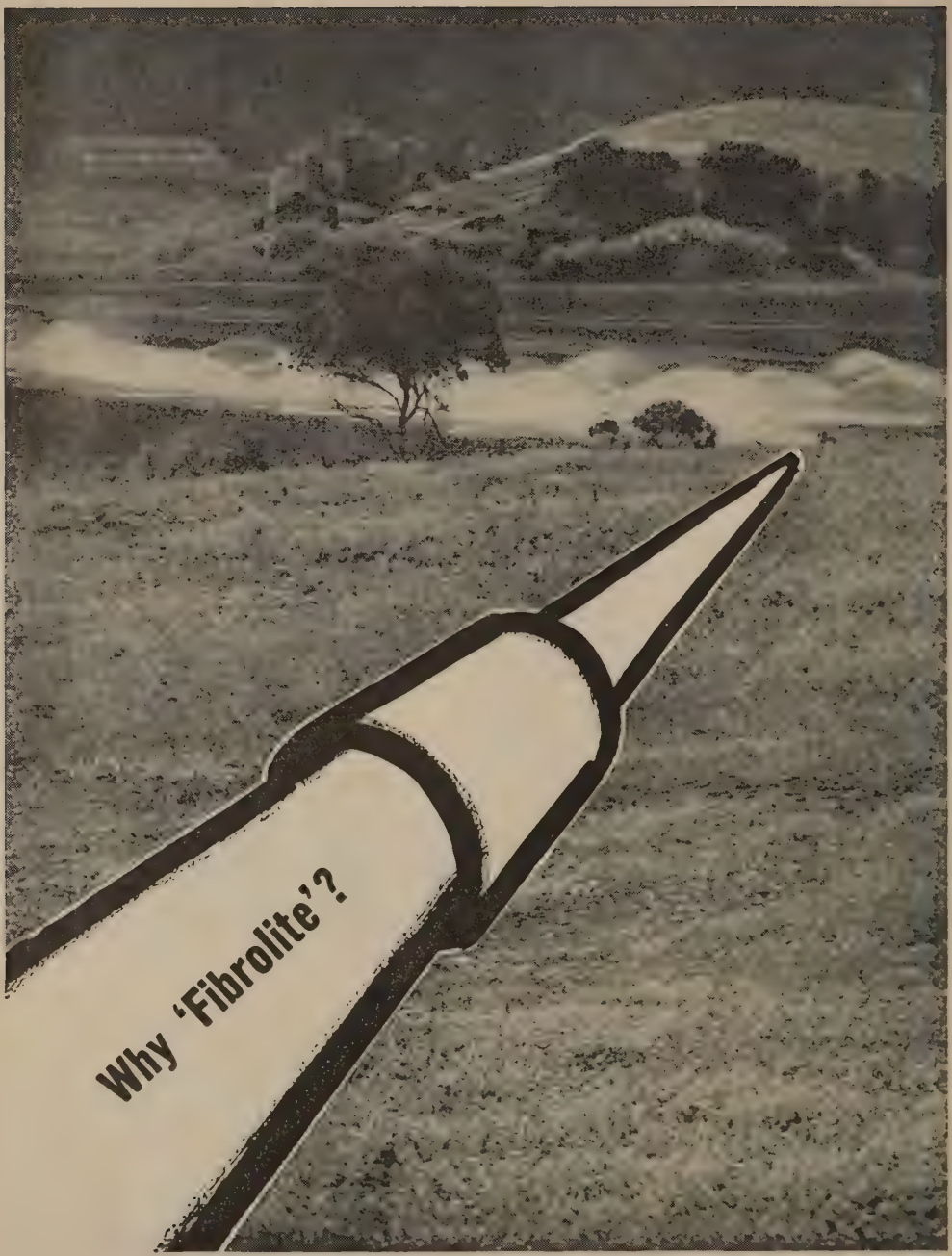
Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		APPLES		
Mites—Bryobia Mite, Red Spider	Dormant Oil	5 gallons in 100 gallons water	July to early August	
	or			
	Superior Oil	3 gallons in 100 gallons water	August to Early September	May be used nearer bud burst.
	or			
	D.N.C. Winter Oil	5 gallons in 100 gallons water	Late July to Early August	Use in areas subject to delayed foliation.
	or			
	Commercial Lime Sulphur	10 gallons in 100 gallons water	August to early September	Apply late in dormant period—when buds begin to swell. Where two sprays are necessary use lime sulphur in August and Superior Oil before green tip. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Metasystox	16 fl. oz. per 100 gallons		
	or			
	Trithion	1 lb. per 100 gallons	November to December if mites still troublesome	*See* precautions for use of these materials.
	or			
	Diazinon	4 pints 20% per 100 gallon		
Powdery Mildew	Lime Sulphur	7 gallons in 100 gallons water (1 in 14 approx.). Add Calcium Caseinate (1 lb. in 100 gallons) as a spreader	Budburst	In early winter prune out and burn all shoots showing mildew infection.
	Colloidal or Wettable Sulphur	4–5 lb. in 100 gallons	From Petal fall onwards at 10–14 day intervals	Check over the trees between green and pink bud stages. Remove all shoot and blossom clusters affected with mildew.
	or			
	Karathane	1 lb. in 100 gallons plus 3 oz. of a liquid spreader such as Triton or Agral L.N.	At petal fall and three further applications at 10–14 days intervals	
Scales—San José' Mussel Scale, Greedy Scale	Dormant Oil	5 gallons in 100 gallons water	July to early August	
	or			
	Superior Oil	3 gallons in 100 gallons water	August to early September	May be used nearer budburst.
	or			
	D.N.C. Winter Oil ...	5 gallons in 100 gallons water	Late July to early August	Use in areas subject to delayed foliation.
	or			
	Commercial Lime Sulphur	10 gallons in 100 gallons water	August to early September	Apply late in dormant period when buds begin to swell. Where two sprays are necessary use Lime Sulphur in August and Superior Oil before green tip. The addition of Gusathion, Diazinon or Parathion as recommended for summer treatments will improve the efficiency of the oil spray. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Superior Summer Oil	1¼ gallons to 100 gallons water	Late November to early December	*See* precautions for use of these materials
	Plus Gusathion ..	0·05%		
	Superior Summer Oil	1¼ gallons to 100 gallons water	Mid-January	
	Plus Diazinon ..	0·05%		
	Superior Summer Oil	1¼ gallons to 100 gallons water	Late February	
	Plus Parathion	0·05%		
Pre-Harvest Drop of Apples (mainly Jonathans)	Naphthalene Acetic Acid	10 parts per million. Follow recommendations of manufacturers	One month before harvest followed by a further spray two weeks before harvest	
	or			
	2, 4, 5 T.P.	10 ppm	One month before harvest	Do not use on fruit for long storage or export.
Thrips	D.D.T.	0·1% (½ gallon 20% D.D.T. to 100 gallons water)	Pinking	This spray gives good control of thrips, reduces blemish and also helps to contro looper caterpillars and iassids.
Woolly Aphis	BHC	0·1% gamma isomer	Spring	Normally controlled by parasites.
		PEARS		
Bryobia Mite Red Spider	Dormant Oil	5 gallons in 100 gallons water	July to early August	
	or			
	Superior Oil	3 gallons in 100 gallons water	August to early September	May be used nearer bud burst.
	or			
	D.N.C. Winter Oil	5 gallons in 100 gallons water	Late July to early August	Use in areas subject to delayed foliation

Fruit Tree Spray Chart—continued

Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		PEARS		
Bryobia Mite Red Spider	Commercial Lime Sulphur	10 gallons in 100 gallons water	August to early September	Apply late in dormant period—when buds begin to swell. Where two sprays are necessary use Lime Sulphur in August and Superior Oil before green tip. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Metasystox *or* Trithion *or* Diazinon	16 fl. oz. per 100 gallons / 1 lb. per 100 gallons / 4 pints 20% per 100 gallons	November to December if mites still troublesome	*See* precautions for use of this material.
Fruit Fly	Malathion	4 oz. Malathion 50%, 2–4 oz. Protein hydrolysate, 4 gallons water	At weekly intervals from 6 weeks before fruit is ripe until 2 weeks after harvest	Spray or splash the bait on to the foliage. Observe orchard hygiene—destroy all fallen and infested fruit. *See* Departmental leaflet on Fruit Fly.
	or	4 oz. Malathion 50%, 2½ lb. Sugar, 4 gallons water		
	Sodium Fluosilicate	Use a recognised proprietary foliage bait or the following :— 1 oz. Sodium Fluosilicate, 2½ lb. Sugar, 4 gallons Water		
	Dipterex	1 pint in 30–60 gallons	14 days and again 3 days before harvest	Use in conjunction with foliage baiting. Use the higher concentration for the first spray if infestation is severe.
Pear Leaf Blister Mite	Dormant Oil . ... *or*	5 gallons in 100 gallons water	July to early August	
	Superior Oil .. *or*	3 gallons in 100 gallons water	August to early September	May be used nearer bud burst.
	D.N.C. Winter Oil .. *or*	5 gallons in 100 gallons water	Late July to early August	Use in areas subject to delayed foliation.
	Commercial Lime Sulphur	10 gallons in 100 gallons water	August to early September	Apply late in dormant period—when buds begin to swell. Where two sprays are necessary use Lime Sulphur in August and Superior Oil before green tip. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Lime Sulphur	1 in 75 or 1¼ gallons in 100 gallons water	Pinking	If further treatment necessary.
	Nicotine Sulphate (Black Leaf 40) Plus Summer Oil .	1 pint in 100 gallons water / 1–1½ gallons in 100 gallons water	When damage first appears	Can be combined with Arsenate of Lead spray for pear slug.
	Lime Sulphur ..	1 in 75	Immediate post harvest	
Pear Scab	1. Captan .... *or* Captan and Phenyl Mercury	1½–2 lb. in 100 gallons / 1½ lb. in 100 gallons ¾ normal concentration (*see* remarks)	Spur burst and early white bud	Recent scab infections can be eradicated by the addition of Phenyl Mercury compounds to the routine captan spray.
	2. Captan	1½–2 lb. in 100 gallons	Blossoming .	Phenyl Mercury compounds should not be used on Josephines or later than petal fall on other varieties because of risk of spray injury to developing fruit.
	3. Captain .... *or* Captan plus Phenyl Mercury	1½–2 lb. in 100 gallons / 1½ lb. in 100 gallons, ¾ normal concentration (*see* remarks)	Petal fall	
	4. Captan	1½–2 lb. in 100 gallons	Cover sprays at 10–14 day intervals as required	Captan can be applied safely during blossoming.
	5. Phenyl Mercury Chloride	0·05%–0·1% active ingredient	After harvest but before leaf fall. Avoid high temperature periods	Greatly reduces disease carry-over after season of severe scab infection. Thorough cover of all leaves is essential.
Pear Slug	D.D.T. .... *or*	0·1% (½ gallon 20% D.D.T. in 100 gallons water)	On appearance of pest—October or November	
	Arsenate of Lead	2 lb. Arsenate of Lead powder per 100 gallons water plus 1 gallon White Oil as a spreader	do. do. do.	Avoid spraying later than December to prevent spray residue on fruit.
Pre-Harvest Drop of Bartlett Pears	Naphthalene Acetic Acid	Mixed as directed	Just before fruit starts to drop	

Fruit Tree Spray Chart—continued

Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		PEARS		
San José Scale	Dormant Oil *or* Superior Oil *or* D.N.C. Winter Oil *or* Commercial Lime Sulphur	5 gallons in 100 gallons water 3 gallons in 100 gallons water 5 gallons in 100 gallons water 10 gallons in 100 gallons water	July to early August August to early September Late July to early August August to early September	 May be used nearer bud-burst. Use in areas subject to delayed foliation. Apply late in dormant period when buds begin to swell. Where two sprays are necessary use Lime Sulphur in August and Superior Oil before green tip. The addition of Gusathion, Diazinon or Parathion as recommended for summer treatments will improve the efficiency of the oil spray. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Superior Summer Oil Plus Gusathion Superior Summer Oil Plus Diazinon Superior Summer Oil Plus Parathion	1¼ gallons to 100 gallons water 0·05% 1¼ gallons to 100 gallons water 0·05% 1¼ gallons to 100 gallons water 0·05%	Late November to early December Mid-January Late February	*See* precautions for use of these materials.
		STONE FRUIT		
Curculio and Fullers Rose Weevil	Dieldrin	0·1–·5% (*see* dilution chart)	December	Use higher concentrations early in the season. Spray the butt of the tree. A foliage spray (·05%) may be necessary for Fuller's Rose Weevil. *See* precautions for using Dieldrin.
Fruit Fly	Malathion *or* *or* Sodium Fluosilicate Dipterex	4 oz. Malathion 50%, 2–4 oz. Protein hydrolysate, 4 gallons water 4 oz. Malathion 50%, 2½ lb. Sugar, 4 gallons water Use a recognised proprietary foliage bait or the following :— 1 oz. Sodium Fluosilicate, 2½ lb. Sugar, 4 gallons water 1 pint in 60–120 gallons	At weekly intervals from 6 weeks before fruit is ripe until 2 weeks after harvest At first sign of strikes. Then at weekly intervals	Spray or splash the bait on to the foliage. Observe orchard hygiene—destroy all fallen and infested fruit. *See* Departmental leaflet. Use in conjunction with baiting. The higher concentration is for first spray only if infestation is severe.
Leaf Curl	Bordeaux Mixture	6 : 4 : 50 plus ½ lb. Calcium Caseinate as a spreader	Any time during dormant period from leaf fall onwards, but before budburst	This spray thoroughly applied will give practically 100% control of leaf curl. For dual control of shot-hole and leaf curl, an autumn leaf-fall application is preferred.
Peach Aphis	Metasystox *or* Nicotine Sulphate and Summer Oil *or* Parathion *or* Malathion *or* H.E.T.P.	16 oz. per 100 gallons 1 pint in 100 gallons water 1 gallon in 100 gallons water 0·01% (*see* dilution chart) 0·02–·03% (*see* dilution chart) 0·01% (*see* dilution chart)	After blossoming on appearance of aphis do. do. do. do. do. do. do. do. do.	A second spray may be required. Dormant oils also help control this pest. *See* precautions.
Red Spider	Dormant Oil *or* D.N.C. Winter Oil *or* Superior Oil *or* Commercial Lime Sulphur	5 gallons in 100 gallons water 5 gallons in 100 gallons water 3 gallons in 100 gallons water 10 gallons in 100 gallons water	Late dormant July Late dormant Prior to budburst	 In areas where delayed foliation occurs. Can be used nearer to budburst. Apply as late as possible in dormant period—when buds begin to swell. This spray is also effective against leaf curl. Where two sprays are necessary use Lime Sulphur in August and Superior Oil prior to green tip. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.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Fruit Tree Spray Chart—continued

Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		STONE FRUIT		
Red Spider	Metasystox	16 fl. oz. per 100 gallons water		
	or			
	Trithion	1 lb. per 100 gallons	November to December if mites still troublesome	*See* precautions.
	or			
	Diazinon	4 pints 20% per 100 gallons		
Rust	Bordeaux Mixture	6 : 4 : 50 plus ½ lb. Calcium Caseinate as a spreader	Leaf fall and early pink bud	Effective also against shot-hole.
Rutherglen Bug	Metasystox	16 oz. per 100 gallons	When pest appears	
	or			
	D.D.T.	0·1–·2% (¼–1 gallon 20% D.D.T. in 100 gallons water)	do. do. do.	The stronger solution is suggested if the pest is particularly troublesome.
	or			
	Malathion	0·05% (¾ pint 50% Malathion in 100 gallons water)	do. do. do.	
	or			
	Malathion	¾ pint 50%	do. do. do.	
	Plus D.D.T.	¼ gallon in 100 gallons water		
San Jose' Scale....	Dormant Oil	5 gallons in 100 gallons water	Late dormant	
	or			
	D.N.C. Winter Oil ...	5 gallons in 100 gallons water	July	In areas where delayed foliation occurs.
	or			
	Superior Oil	3 gallons in 100 gallons water	Late dormant ..	Can be used nearer to budburst.
	or			
	Commercial Lime Sulphur	10 gallons in 100 gallons water	Prior to budburst	Apply as late as possible in dormant period—when buds begin to swell. This spray is also effective against leaf curl. Do not use on apricots. Where two sprays are necessary use Lime Sulphur in August and Superior Oil prior to green tip. The addition of Gusathion, Diazinon or Parathion as recommended for summer treatments will improve the efficiency of the oil spray. Coverage must be thorough for dormant sprays. Avoid spraying when trees are wet or just before rain.
	Superior Summer Oil	1½ gallons to 100 gallons water	Late November to early December	
	Plus Gusathion	0·05%		
	Superior Summer Oil	1½ gallons to 100 gallons water	Mid-January	*See* precautions for use of these materials.
	Plus Diazinon	0·05%		
	Superior Summer Oil	1½ gallons to 100 gallons water	Late February	
	Plus Parathion	0·05%		
Shot-Hole	Bordeaux Mixture	6 : 4 : 50 plus ½ lb. Calcium Caseinate as a spreader	Leaf fall	Spray before majority of leaves have fallen This spray is the most important spray for shot-hole control.
	Bordeaux Mixture	6 : 4 : 50 plus ½ lb. Calcium Caseinate	Early pink bud	This spray is necessary for shot-hole control in addition to the Autumn spray.
	or			
	Thiram	1½ lb. in 100 gallons	Petal fall and at 14 day intervals if required	The number of sprays required subsequent to petal fall will depend on weather conditions. Thiram does not damage leaves or fruit.
		CITRUS		
Aphis	Metasystox	16 oz. per 100 gallons	On appearance of aphis	
	or			
	Nicotine Sulphate (Black Leaf 40)	1 pint in 100 gallons plus 1 pint liquid detergent or 1 gallon Summer Oil as a spreader	do. do. do.	A second spray may be required.
	or			
	Parathion	0·01% *see* dilution chart	do. do. do.	*See* precautions for use of these materials.
	or			
	Malathion	0·02% *see* dilution chart		
	or			
	H.E.T.P.	0·01% *see* dilution chart		
Brown Rot	Bordeaux Mixture	4 : 4 : 50. Add White Oil (1 in 100) or Calcium Caseinate (1 lb. in 100 gallons) as a spreader	Early August	Thoroughly spray lower two-thirds of tree. A Spring application of Bordeaux is especially important for lemons.
			And again	
			Mid- to late April. Preferably before first rains	Spray thoroughly lower two-thirds of tree and soil under the branches. This spray is particularly important for oranges and mandarins.

Fruit Tree Spray Chart—continued

Pest or Disease	Spray Material	Concentration	Time of Application	Remarks
		CITRUS		
Fruit Fly	Malathion	4 oz. Malathion 50%, 2–4 oz. Protein hydrolysate, 4 gallons water	At weekly intervals from six weeks before fruit is ripe until two two weeks after harvest	
	or			
		4 oz. Malathion 50%, 2½ lb. Sugar, 4 gallons water	do. do. do.	Spray or splash bait onto the foliage. Observe orchard hygiene. Destroy all fallen and infested fruit.
	Sodium Fluosilicate	Use a recognised proprietary bait or the following :—Sodium Fluosilicate 1 oz., Sugar 2½ lb., water 4 gallons	do. do. do.	*See* Departmental leaflet on fruit fly.
Fuller's Rose Weevil	Dieldrin	0·05% *see* dilution chart	December	Apply as a foliage spray using 1 gallon of spray per tree. The use of Dieldrin may cause a build-up of red scale. *See* Precautions for using Dieldrin.
Pre-harvest Drop of Washington Navels	2,4-D	*See* manufacturer's recommendations	June	Thoroughly wet leaves and fruit.
Red and Black Scale	Summer Oil	2½ gallons (Superior Summer 2 gallons) in 100 gallons water	When scales are emerging (January, February, March, for Red Scale, December for Black Scale)	Spray thoroughly. Heavy infestations may require two sprays. Avoid spraying in heat or when trees are stressed for water.
	or			
	Parathion	0·075–0·1%. *See* dilution chart	do. do. do.	*See* precautions for use of these materials. Parathion may cause a build-up of soft brown scale. White Oil or Malathion are preferable where this scale is present.
	or			
	Malathion	0·1–0·2%. *See* dilution chart		
Soft Brown Scale	Summer Oil	2½ gallons (Superior Summer 2 gallons) in 100 gallons water	Where scales are emerging (about December)	Spray thoroughly. Avoid spraying in heat or when trees are stressed for water.
	or			
	Malathion	0·1–0·2%. *See* dilution chart	do. do. do.	Do not use Parathion for Soft Brown Scale.
White Wax Scale	Summer Oil	2½ gallons (Superior Summer 2 gallons) in 100 gallons water	When young scales first appear on leaves (December and January)	Two sprays a fortnight apart give best results. Spraying must be thorough. Avoid spraying in heat or when trees are stressed for water. This spray will also help control Red Scale.
	or			
	White Oil	2½ gallons	March to early April	A successful spray for later in the season. Should not be applied later than mid-April. Spraying must be thorough.
	And Soda-ash	25 lb. (or 60 lb. washing soda) in 100 gallons water		
	or			
	Soda-ash	7½ lb.	do. do. do.	Eliminates the use of White Oil and hence reduces the susceptibility to water spot.
	Plus liquid detergent....	1 pint in 100 gallons water		
Snails and Slugs	Bordeaux Mixture	4 : 4 : 50	When snails appear....	Bordeaux sprays in Spring and Autumn for Brown Rot will usually give adequate control.
	or			
	Metaldehyde Bait	Metaldehyde 1 lb., Bran 30 lb., Calcium Arsenate 2 lb. (or 1 lb. 10% B.H.C.)	do. do. do.	Mix the bait thoroughly and place heaps around the trees.
White Fly	Metasystox	16 oz. per 100 gallons		
	or			
	Summer Oil	2½ gallons (Superior Summer 2 gallons)	When the main emergence of adults is completed (2–3 weeks after large numbers appear)	A second spray may be required in case of severe outbreak. The trees should be sprayed thoroughly.
	and			
	Nicotine Sulphate	1 pint water 100 gallons		
	or			
	Parathion	0·01–0·02%. *See* dilution chart	do. do. do.	
	or			
	Malathion	0·04%. *See* dilution chart	do. do. do.	*See* precautions.
	or			
	H.E.T.P.	0·02%. *See* dilution chart	do. do. do.	

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SELENIUM

An Essential Trace Element

SELENIUM is one of the rare elements. In most soils it occurs in such minute quantities as to escape attention. Plants, however, can concentrate selenium in their tissues and, in the U.S.A. in areas where the soils contain more selenium than usual, this facility can result in selenium poisoning in grazing animals. Only minute traces of the element are required to produce these toxic effects. "Wheat grown on soil containing two parts per million of selenium might concentrate this element to the extent of 25 parts per million in the grain, more than double the quantity needed to produce a grave poisoning in farmstock" (Daniel, 1939). As little as five parts per million of selenium in the edible fraction of pasture is considered to be dangerous for grazing animals.

Fortunately, none of the common soil types in Australia appears to contain enough selenium to affect the quality of the herbage. Research workers have remained alert to the possibility, however. Some years ago, for example, the suggestion was made that certain stock losses in the Kimberleys could be due to excessive selenium. Analyses of fodder samples gave no indication of any accumulation of this element.

NECESSARY FOR WELLBEING

Selenium is now attracting attention for reasons quite distinct from its toxic properties. It has now been shown that minute quantities of selenium are essential for the health and wellbeing of living creatures. About ten years ago research workers found that disease symptoms in rats, previously considered to be due to lack of Vitamin E, could be prevented by a "factor 3" which contained no Vitamin E (Schwartz, 1951). Subsequent work (Schwartz and Foltz, 1957) showed that traces of selenium salts added to the basal diet effectively prevented the development of the disease in question.

For many years, breeders of sheep and cattle in specific regions throughout the world have been troubled with losses of calves and sheep from a condition known variously as "white muscle disease," "stiff lamb disease," or "muscular dystrophy." These losses have been ascribed to lack of Vitamin E, but treatment of breeding stock and affected young animals with the vitamin, has not always given the response to be expected. When it became known that selenium could prevent and cure abnormalities in laboratory animals previously attributed to Vitamin E deficiency, tests were carried out with farm animals. It soon became apparent (Hogue, 1958; Grant *et al,* 1959) that traces of selenium could produce remarkable improvements in sheep affected with "white muscle disease." These beneficial results were obtained by the administration of minute amounts of selenium to the pregnant ewe, or to the new-born lamb.

NEW ZEALAND EXPERIMENTS

The discovery that selenium is an essential trace element appears to be of great importance to farmers in New Zealand. In the South Island of N.Z., in particular, "white muscle disease" has caused serious losses of lambs for many years. Vitamin E injections have been used with varying success but workers at the Wallaceville Research Station have now shown that selenium is much more dependable in the prevention and cure of the disease. Workers in Great Britain (Sharman *et al,* 1959) have likewise shown

that selenium is much more effective that Vitamin E in preventing muscular dystrophy in calves. In New Zealand, Jolly (1960) likewise found that an ill-thrift problem in calves on pumice soils could be corrected by two injections of sodium selenite. One month after the first injection the treated calves showed an average increase in body weight of 41 lb. compared with only 27 lb. in the controls.

As would be expected, a considerable volume of research work is now in progress in the affected areas of New Zealand. It has been clearly established that the proper use of selenium salts will provide an effective and economical control of white muscle disease. Much remains to be learnt, however, concerning the best method whereby the selenium should be supplied. In the affected areas, injections of minute amounts into lambs soon after birth and at intervals thereafter have given excellent control. So also have equally small doses given per mouth. No definite recommendations can yet be given, however, as to which is the best method, or how many doses are required. It is to be expected, of course, that methods of treatment will vary according to the severity of the deficiency. In some areas, the disease only appears in lambs for a short period after marking, while in other areas many lambs die soon after birth. In the latter case it would appear preferable to treat the ewes rather than the lambs. In some of N.Z. trials, selenium given to the ewe has not resulted in absolute control. It seems logical, however, to provide the essential trace element to the ewes as well as the lambs.

Providing selenium to the ewes may be important for another reason. Recent work in New Zealand (Hartley *et al*, 1960) indicates that inadequate intakes of selenium could contribute to the low fertility characteristic of many flocks in afflicted areas. In the South Island on 21 properties where "white muscle disease" occurred in the lambs, ten of the flocks contained 30 per cent., or more, of barren ewes. Controlled experiments were carried out to determine if fertility could be improved by giving each ewe 5 mgm. of selenium at monthly intervals from one month before mating to just prior to lambing. Not only did these injections eliminate "white muscle disease" in the lambs, but there were many less barren ewes and a marked increase in lambing percentages. In one experimental flock, for example, the lambing percentage increased from 61 per cent. to 95 per cent., while the percentage of barren ewes fell from 31 per cent. in the control group, to 8 per cent. in the treated group.

WEST AUSTRALIAN OBSERVATIONS

In Western Australia there are many farmers who are concerned with low lambing percentages, failure of lambs to survive after birth, and with the slow rate of growth of lambs and weaners. The successes obtained with selenium in New Zealand can be expected to raise hopes that this element may provide the solution to similar problems in Australia.

It is possible that areas suffering from selenium deficiency will be found but it is well to remember that selenium has proved beneficial mainly, if not entirely, in areas where white muscle disease occurs. As far as is known at present, white muscle disease is of rare occurrence in West Australia. During the last ten years only two or three supposed cases have been reported to the Animal Health Laboratory, but no clear-cut diagnosis has been made. Nonethe-less, it is possible that border-line selenium deficiency could be reducing the well being of lambs and calves in some districts of this State.

Controlled experiments were started in Western Australia some months ago, to determine whether selenium will increase the growth rates of lambs in districts where lamb losses have been excessive, or where weaners do not thrive. With the co-operation of local farmers, District Advisers and Veterinary Officers injections of the requisite traces of selenium have been given at monthly intervals to half the animals in flocks of at least 100 lambs or weaners. The test animals are being weighed at the beginning and end of each trial.

In New Zealand where selenium has been beneficial, such injections are followed by obvious increases in growth rates. In results which have already come to hand from the Albany district (Bornholm and Mt. Manypeaks) the treated lambs and weaners have not gained any more weight than the controls. Further trials are being commenced in other dis-

tricts as lambs become available for treatment. By carrying out these experiments on selected farms where symptoms suggestive of "ill thrift" have occurred it should be possible to determine if lack of selenium is a disability. The tests will have to be carried out in several successive years, if negative results are obtained, because trace element deficiencies do not necessarily show up every season. In borderline areas, for example, cobalt deficiency may only cause losses in one year in five. When the losses do occur, however, these can be costly.

The recent discoveries which have been made concerning the importance of selenium in livestock rations will be of great economic value to farmers in the affected areas of New Zealand. In all parts of the world students of animal nutrition will now be carrying out trials to see whether selenium is needed in a host of different environments. As trace elements have played such an important part in the development of Western Australia it is natural that our farmers will be interested to learn if selenium is another element which must be provided. The current series of trials should give a definite answer. Meantime, it may be as well to remind farmers that as little as five parts of selenium in a million parts of herbage will be toxic to grazing animals. Selenium supplements should not be used until there is definite evidence that these are needed.

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CORRECTIONS

In the article on Cape Tulip (Pages 593 to 599 in the July issue of "The Journal of Agriculture") some words were omitted from the seventh line on Page 598.

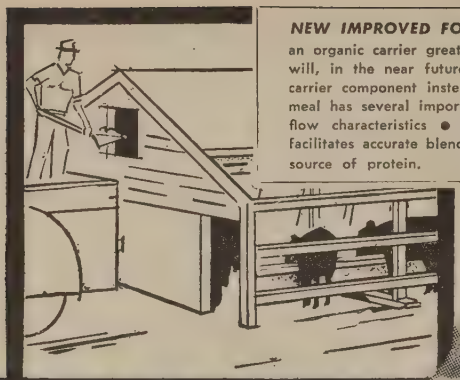
Instead of reading "One hundred gallons per 48 square yards"—this should read "One hundred gallons per acre, that is one gallon per 48 square yards, is a convenient rate, etc."

In "Studies in the Mulga Pastoral Zone" (Pages 581 to 586) the first line in Table I should read 137.0 not 13.7.

In the article on Lamb Marking by I. K. Stott (Page 604 of the July issue), the instructions on ear-marking should read:—

Mark males on the right or off ear.

Mark ewes on the left or near ear.



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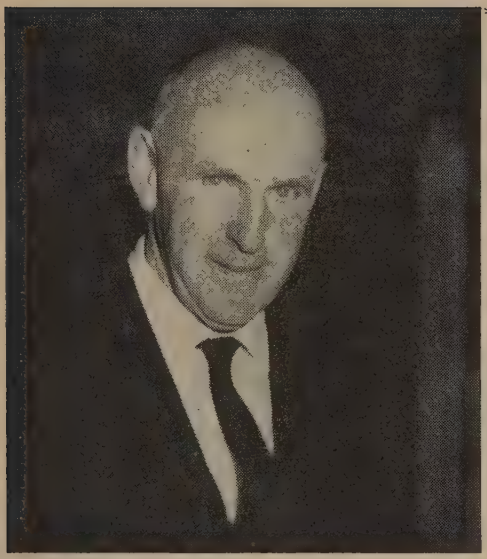

Government Botanist Retires

MR CHARLES AUSTIN GARDNER, West Australian Government Botanist since 1927, retired from active service with the Department of Agriculture on July 5, 1960.

Mr. Gardner was born in Lancaster, England in 1896. As a boy he was keenly interested in botany and this interest was maintained when his family migrated to Western Australia in 1910. In 1920 he obtained his first Governmental appointment as botanical collector with the Forests Department and in the following year was a member of the Kimberley Exploration Expedition which investigated the north-west portion of the Kimberley Division of Western Australia.

In 1924, Mr. Gardner joined the staff of the Department of Agriculture and was appointed to the position of Government Botanist in 1927.

In 1937 he was appointed as the first Australian Liaison Officer to the Kew Herbarium in England and on his return to Western Australia in 1939 he commenced the task of re-organising the Perth Herbarium on scientific lines together with the preparation of a Flora of Western Australia.

One volume of the Flora has already been published and a mass of information has been collected which will be incorporated in the succeeding volumes. Mr. Gardner will continue his work on the Flora, after his retirement.

An energetic and enthusiastic field collector for many years, Mr. Gardner has travelled throughout the length and breadth of Western Australia covering many thousands of miles on foot in carefully-conducted botanical surveys of remote areas.

He has made many oustanding contributions to technical literature and has written a large number of articles of a more popular nature for "The Journal of Agriculture" and other publications.

His contributions to books on the wildflowers of Western Australia have aroused keen interest in our unique flora throughout the world, and he was co-author with Dr. H. W. Bennetts, of the book "Toxic Plants of Western Australia" which contained 45 line drawings and 15 water-colours by C. A. Gardner.

Western Australia has been particularly fortunate in having as its Government Botanist, a man who—in addition to possessing a wealth of scientific knowledge and the physical ability to range far afield in the pursuit of further knowledge—is a

talented artist. Through his drawings and paintings, which represented thousands of hours of pains-taking work, Mr. Gardner has been able to record for posterity much of the information garnered during a long and active career.

A keen photographer, he has also accumulated a magnificient collection of colour photographs of West Australian plants.

Stockowners throughout the State, and particularly in the northern pastoral areas are deeply indebted to Mr. Gardner for his research into stock losses from poison plants.

In 1940-44 he investigated the cause of extensive mortalities among animals travelling along the North-West stock routes and successfully identified a number of toxic species.

When in 1949, a co-operative investigation into Kimberley Horse Disease, the so-called "Walkabout Disease," was inaugurated, the C.S.I.R.O., the Animal Industry Division of the Northern Territory and the West Australian Department of Agriculture collaborated in a huge survey of the distribution of the disease.

An important feature of the research was the botanical survey by Mr. Gardner of the plants on affected and non-affected areas which led to the incrimination of a species of *Crotalaria* ("Wedge-leaved Rattlepod) as the cause of the disease. This was subsequently proved by feeding tests and analyses.

Readers of "The Journal of Agriculture" who have shown keen interest in Mr. Gardner's illustrated articles on "Trees of Western Australia" will be pleased to know that he intends to continue the series and that the illustrations will subsequently be used in a special section of the Flora of Western Australia.

A confirmed bachelor, Mr. Gardner prides himself on his cooking ability and despite an almost life-long addiction to strong-smelling pipes he has retained a discriminating palate and is a good judge of wines.

Officers of the Department of Agriculture who gathered to bid him farewell, paid him many sincere tributes and presented him with a number of records to augment the already extensive collection of musical classics which is another of his hobbies.

TRACTOR SAFETY

Only one person—the operator—should be permitted on the tractor platform when tractor is in operation.

The rate of tractor travel on hillsides and curves should always be such that there is no danger from tipping.

Refuel your tractor only when the engine has been shut off. Do not smoke or use an oil lantern while refueling.

When refilling the radiator be sure there is no steam pressure behind the cap to cause scalding when it is removed.

Be sure power-take-off shields and guards are in place and in good order before starting field work.

Tractor brakes should be properly adjusted.

Do not oil, grease or adjust a farm machine that is in motion.

Clothing worn by tractor or machine operator should be fairly tight and belted. Loose jackets, skirts, shirts, or sleeves should not be permitted because of the danger of them getting into the moving parts.

All women operators should wear trousers or slacks.

Never drive a tractor too close to the edge of a ditch or creek.

Never operate your tractor in a closed garage or shed.

Be sure the gear shift lever of your tractor is in neutral before starting the engine.

When your tractor is hitched to a heavy load, always hitch to drawbar and never take up the slack in chain with a jerk.

Always keep tractor in gear when going down steep grades.

Never ride on drawbar of tractor or drawn implement.

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Honey Flora Calendar for September

COMPILED BY R. S. COLEMAN, APICULTURAL SECTION, WITH ASSISTANCE FROM THE BOTANICAL BRANCH

Common Name	Botanical Name	Where Found	Honey		Quality of Pollen	Remarks
			Quality	Quantity		
Peppermint	*Agonis flexuosa* (Spreng.) Schau	Coastal plain, and as an ornamental	Very Poor	Good	None	Very poor honey; main flowering September to October.
Silky Blood Flower	*Calothamnus sanguineus*, Labill.	Widespread; seems to like rocky slopes either lime or ironstone	Dark, good quality	Excellent	Good	Flowers over a long period.
Geraldton Wax	*Chamaelaucium uncinatum*, Schau	Native to coastal limestone ridges and coastal strip of Geraldton	Poor	Good	Good	Mainly as an ornamental.
Gooseberry Mallee	*Eucalyptus calycogona*, Turcz.	Drier portions of Southern Australia; found in W.A. in mallee areas	Unknown, probably good	Good	Good	Could be a useful tree; a tree that should be watched and tried over a number of years.
Mealy Blackbutt	*Eucalyptus celastroides*, Turcz.	Mallee area	Unknown	Unknown	Unknown	The activity of insects on these trees when flowering indicates they could be good honey producers.
Poot	*Eucalyptus decipiens*, Endl.	Coastal plain, as a tree very much like the tuart, and as a mallee on the coastal plain and in the mallee areas	Good	Good	Good	Not a tree worked extensively by beekeepers; apparently flowers on alternative years, long-flowering, August to November.
Karri	*Eucalyptus diversicolor*, F. Muell.	Coastal karri would be fading out in this month	Excellent	Excellent	Poor	Very little karri honey produced in September due to weather.
Blue Mallet	*Eucalyptus Gardneri*, Maiden	Great Southern	Excellent	Good	Excellent	Irregular flow, probably due to weather; flow usually occurs at the end of its flowering period, also probably due to weather.
Snap and Rattle Yorrel, Small Budded Mallee	*Eucalyptus gracilis*, F. Muell.	Widespread mallee	Good	Differing reports	Good	Differs apparently from district to district in yield.
Lerp Mallee	*Eucalyptus incrassata*, Labill.	Widespread throughout southern areas in the mallee-wheat areas	Good	Good	Good	There is a doubt about the flowering time of this tree although it seems to flower over a long period. The main period seems to be in the winter.
York Gum	*Eucalyptus loxopheba*, Benth.	Wheatbelt in heavier rainfall area	Good	Excellent	Poor	One of the major nectar-bearing trees.
Bullich	*Eucalyptus megacarpa*, F. Muell.	Associated with coastal and karri areas	Choice	Good	Good	A good build-up for karri. Too scattered to be much good.
Redwood	*Eucalyptus oleosa*, F. Muell. var. *glauca*, Maiden	Mallee areas and wheatbelt	Not enough known	Good	Good	Never been worked by commercial beekeeper but has indications of being a good flow. Tree flowering time is uncertain, but probably December.

Flooded Gum	*Eucalyptus rudis* Endl.	Watercourses, etc. It is a species which is associated with water	Good	Good	Good	One of the major honey plants; flowers alternative years. In some areas it is attacked by lerp insects that almost completely defoliate the trees and this almost stops flowering and the nectar flow.
Long-thin Leaf Paper Bark	*Melaleuca rhaphiophylla*	Swamps and river banks in South-West Division	Poor ..	Good ...	Good	Supposed to give honey regularly every year, but as it grows in association with Flooded Gum, the contribution of each plant is difficult to determine.
Sweat or Honey Bush	*Adenothos cuneata*, Labill.	Southern sandplain	Unknown	Good	Good	Very few beekeepers operate in the areas where this plant grows and this could be a major honey plant of the future.
Holly Leaf Banksia	*Banksia ilicifolia*, R.Br.	Low areas but not swamp in coastal plain	Unknown	Uncertain	Good	Long-flowering.
Diamond Bush	*Bossiaea Laidlayiana*, Tovey et Morris	A shrub of the karri forest	Good	Good	Excellent .	With capeweed is regarded as one of the best pollen sources. Bees tend to swarm on it.
Pingly Bush	*Dryandra armata*, R.Br.	Gravel soils. Darling Range and south; not widespread	Good	Good	Good	Only one report on this plant but that report was good all round.
Pingly Bush or Pindli	*Dryandra carduacea*, Lindl.	Widespread, tends to cover a solid area and likes good clay-gravel soils	Good-poor ..	Very good ..	Very good	One of the best of the minor honey plants.
Parrot Bush	*Dryandra floribunda*, R.Br.	Widespread, on gravelly soils and limestone hills	Good	Excellent	Very good ..	One of the major honey plants. From results on the coastal plain it seems to require heavy early winter rains to produce well, and only those plants on limestone seem to produce. This may be due to the fact that the limestone hills are along the coast and are therefore warmer in the spring.
Reminder Bush ..	*Hakea recurva*, Meissn.	Widespread	... ...	Worked by bees	Apparently good ...	Not enough known about this plant.
	Hakea scoparia, Meissn.	Midlands, Coorow-Moora	Good	Good	Good	Good flow, sensitive to frost; nectar worked only when thick.
White Bush	*Hakea trifurcata* (Sm.) R.Br.	Widespread	Good	Good	Good	A most valuable plant, both in its timing and value in building up the bees.
Radiata Pine	*Pinus radiata*, D. Don.	Plantations	None	None	It is worked by the bees and bees do well on it	Flowers August to September.
Wild Hop	*Chorilaena hirsuta*, Benth.	Karri forest	Good	Good	Good	The honey of this plant has a marmalade taste, and is of good colour.
Orange	*Citrus sinensis*, Pers.	Cultivated	Excellent	Good-Poor	Good	One of the word-famous honeys.
White Clematis	*Clematis pubescens*, Hueg.	A creeper; widespread through South-West Division	Unknown ...	Little	Excellent ...	Reported frequently as an excellent pollen plant.
	Phebalium microphyllum, Turcz.	Widely spread in marginal and pastoral areas	Good	Good	Good	Very little known, but reported to be worth watching

It will be seen from this list that information concerning many nectar-bearing plants is far from adequate. We would appreciate further information from beekeepers.

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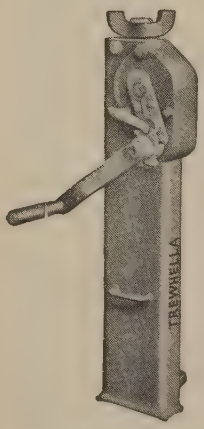

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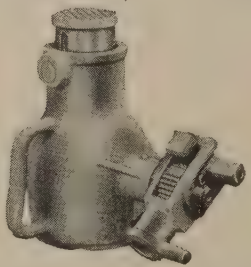

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PLANT DISEASES

Powdery Mildew or Oidium of Grapes

By H. L. HARVEY, B.Sc. (Agric.), Senior Plant Pathologist

POWDERY mildew or oidium, is a disease which is always present to a greater or lesser extent in grapevines in Western Australia. In seasons favourable for its development it stunts the growth of shoots and leaves and may seriously reduce fruit yields and quality. Most of our commonly-grown varieties are quite susceptible to the disease, but for the reason that currants are the most extensively grown variety, the overall losses are greatest in this variety.

Fig. 1.—Grape leaf with much of the surface covered with powdery mildew

In the early stages of infection, small light green to yellow spots may appear on the leaves. Later the disease becomes conspicuous as a dirty white powdery growth on all green parts including leaves (Fig. 1) shoots and fruit (Fig. 2). The mildew may be rubbed off easily and beneath it on the affected part, a dark mark with a web-like pattern may be seen (Fig. 4). Second-year canes often show these dark patches as a result of infection during the previous year. Fruit that is blemished in this way is unattractive on the local market and unacceptable for export. Furthermore, affected fruit may split (Fig. 3) and thus be rendered useless. "Shelling" or the drying up of the pulp may also follow cracking and is especially damaging in dried vine fruits such as currants.

CAUSE

Powdery mildew is caused by the fungus *Uncinula necator* (Schw.) Burr., (*Oidium tuckeri*) which spreads rapidly during

Fig. 2.—Powdery mildew on grapes

showery or overcast weather when conditions are cooler than normal in summer. Fortunately, in our commercial vineyards, this combination of weather conditions occurs only infrequently and consequently the occurrence of powdery mildew in severe form is correspondingly infrequent. This is illustrated by the fact that between the serious outbreaks of 1947-48 and 1959-60, there were 12 years of comparative freedom from disease.

On the other hand it occurs more frequently in home gardens where sheltered conditions and rank growth increase the powdery mildew risk. This is the result of the practice in many cases, of encouraging extensive foliage growth on trellises for shade purposes in the garden.

CONTROL

The main method of controlling this disease is by prevention, rather than by attempting to cure the disease after it has become established. Dusting sulphur, or alternatively spraying sulphur (e.g., Wettsul, Cosan, Spersul, Microtomic sulphur,

Fig. 3.—Bunch with some splitting berries, following powdery mildew attack

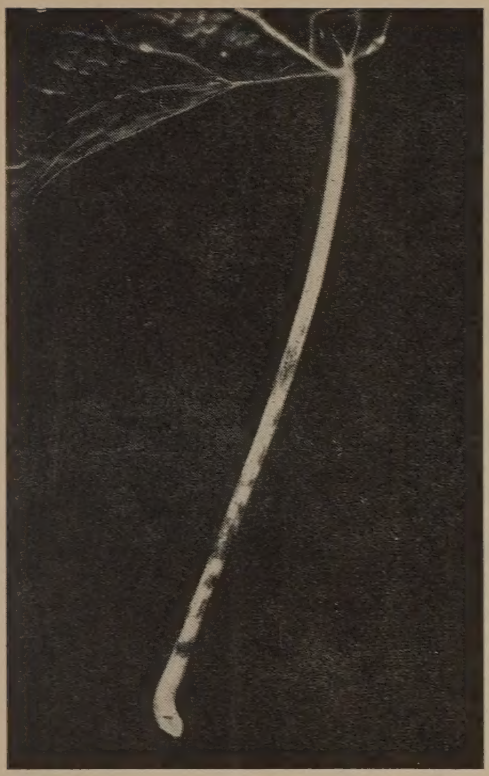

Fig. 4.—Dark, web-like marks on a leaf petiole as a result of powdery mildew attack

etc.), should be applied as a preventive measure commencing early in the season—

(a) when shoots are 2 in. to 4 in. long;
(b) three weeks later;
(c) immediately after fruit set.

Note.—It is convenient to incorporate spraying sulphur with the Ziram or Thiram sprays which are recommended at these stages for the control of black spot (Anthracnose).

(d) Any subsequent applications of sulphur would be dictated by weather conditions. For instance, whenever showery, overcast, relatively cool weather occurs during the summer, applications should be repeated at about ten-day intervals. Spraying sulphur and dusting sulphur are equally effective but in commercial vineyards the foliage has become dense about this time of year and power dusting probably gives better penetration and coverage than sprays. Dustings at 5 to 10 lb. per acre should be made at the first break in the weather, preferably in calm, dry weather.

Sulphur protects vines from powdery mildew, but will not eradicate it, once it has become established. Therefore, it is emphasised that adequate control can only be achieved by adhering strictly to the recommended schedule. To delay the early treatments or to apply sulphur too infrequently during favourable summer weather will increase the powdery mildew risk accordingly. It is pointed out that reliance should not be placed on sulphur acting at a distance and that a complete coverage of all green parts is necessary to give efficient protection. Spraying or dusting methods which do not achieve this should be discarded.

CEMENT WASH FOR HESSIAN

The ubiquitous chaff and cement bag can be turned to good account in the construction of outhouses, chicken sheds, feed rooms, etc. The following method which has been used with every success, is both economical and easy to manipulate.

A framework of timber is first of all built up, after which chaff or cement bags are opened out and stretched very tightly over it, being nailed down with $\frac{3}{8}$ in. clout tacks. Next a mixture is made up as follows: Water 1¼ gallons, cement 12 lb., lime 2 lb., salt 1 lb., alum ½ lb. (In damp weather use one pint less water). Sift the salt and lime together through a fine sieve to thoroughly mix and get rid of any big lumps, add this to the water, and then follow with the cement—stirring while adding—finally add the alum. Apply this mixture immediately with a fairly stiff brush to the stretched bags, first on the outside and then on the inside. Before the mixture sets, but after the initial wetness disappears, apply a second coat to the outside. When this sets the bags will be quite hard and stiff. Subsequent coatings will, of course, make a stronger board.

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MURESK AGRICULTURAL COLLEGE

(Department of Agriculture)

Parents are reminded that applications for 1962 admission to Muresk Agricultural College close on December 31 of this year. A preliminary selection of 1962 entrants is made after the Junior results are available early in 1961.

The successful applicants then continue with Sub-Leaving, or higher studies, in 1961.

Before the course can be commenced students must have attained:—

(a) Sub-Leaving Standard in English, Maths. A, Chemistry and Physics (including Magnetism and Electricity).

(b) Junior Standard Bookkeeping.

Should places still exist for 1962 commencement after the preliminary selection early in 1961, they are filled in order of application during 1961, by qualified applicants.

Duration of Course.—Two years.

Fees.—Approximately £180 per annum covering full residential charges.

Scholarships.—Department of Agriculture (3), the "Countryman," and J. J. Poynton Memorial (2).

Boarding Allowance.—Most Muresk students are eligible for the Education Department Boarding Allowance (£50 per annum).

Full details of the College are obtainable from the Principal, Muresk Agricultural College, Muresk, W.A., or the Department of Agriculture, Perth.

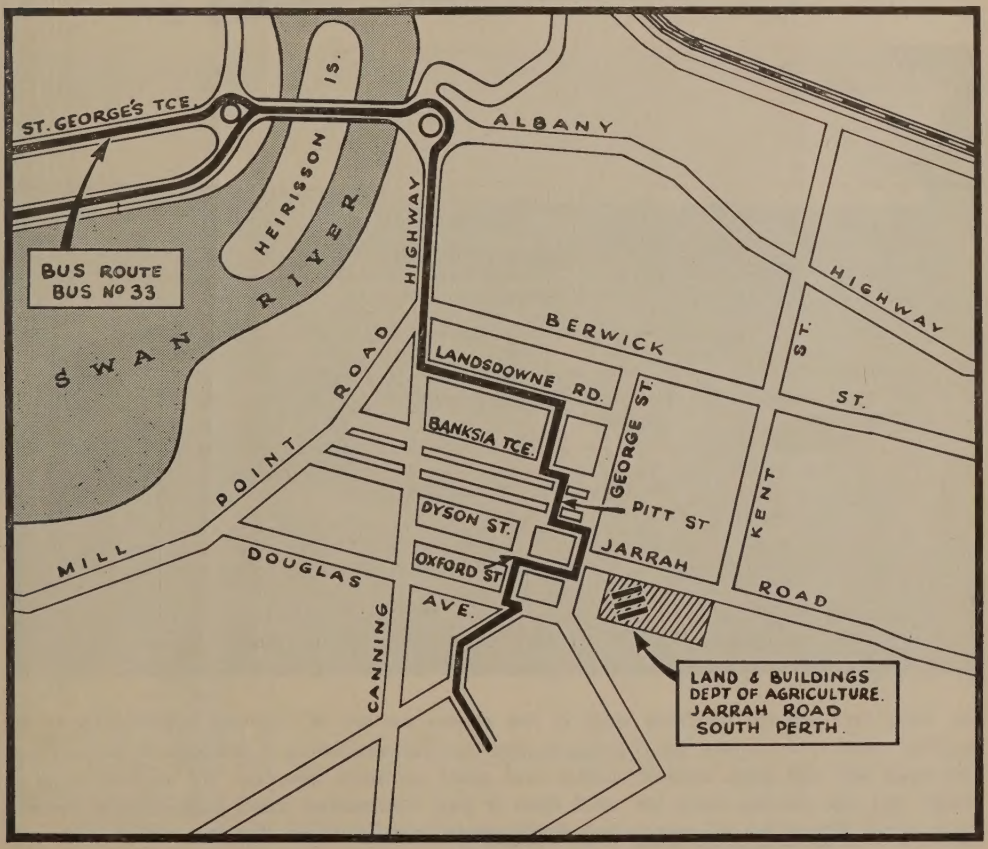
ANIMAL DIVISION . . .

Moves to South Perth

THE Animal Division of the Department of Agriculture — which includes the Veterinary Branch, the Animal Health and Nutrition Laboratories and the Poultry Branch—was transferred to new premises at Jarrah Road, South Perth, early in July.

All inquiries on veterinary and poultry matters should now be addressed to the Department of Agriculture, Jarrah Road, South Perth.

With the transference of the Veterinary and Poultry Branches from St. George's Terrace and the Animal Health and Nutrition Laboratories from Smythe Road,



Hollywood, all the technical branches and divisions of the Department of Agriculture are now located in a group of three modern two-storey buildings situated on a 30-acre site which once formed portion of the northern corner of the Collier Pine Plantation.

The site is bounded on the north-east by Jarrah Road and on the north-west by George Street (see map).

The new buildings will be officially opened by the Premier (Hon. D. Brand, M.L.A.) on August 26.

A fourth block of buildings to house the administrative staff of the Department is now under construction.

The old Department of Agriculture building in St. George's Terrace will remain open for the time being to receive orchard registrations, but all technical inquiries should now be addressed to the South Perth centre.

Erosion in Crop Land

The sand you use for concrete work is the coarse portion of the soil which used to be growing crops and pasture on the slopes nearby. You are using a product of erosion but you have lost the clay, organic matter and plant nutrients forever. By way of reduced yields you are paying more for sand than if you transported sand from natural sources miles away. Use it by all means but don't create more deposits for the use of your son.